

Screening of Alternatives



Agreement No: 36893013
DOT&PF Project No: 67698
Federal Project No: ACHP-0922(5)

Prepared for:



State of Alaska
Department of Transportation and
Public Facilities
6860 Glacier Highway
Juneau, Alaska 99801

Prepared by:



HDR Alaska, Inc.
712 West 12th St.
Juneau, AK 99801

November 2000

1.0	INTRODUCTION	1
2.0	SCREENING FACTORS.....	1
2.1	Cost Factors	2
2.2	Purpose and Need Factors	2
2.3	Physical Environmental Factors.....	4
2.4	Transportation Factors.....	6
3.0	PROJECT FACT SHEETS	7
	No Action Alternative.....	8
	OPTION A: HIGH-LEVEL BRIDGE – REFUGE COVE AREA.....	10
	OPTION B: HIGH-LEVEL BRIDGE – PENINSULA POINT AREA.....	13
	OPTION C1: HIGH-LEVEL BRIDGE – AIRPORT AREA NORTH.....	16
	OPTION C2: HIGH-LEVEL BRIDGE – AIRPORT AREA SOUTH	19
	OPTION C3: MODIFIED HIGH-LEVEL BRIDGE –	22
	AIRPORT AREA TO SIGNAL ROAD.....	22
	OPTION C4: MODIFIED HIGH-LEVEL BRIDGE –	25
	AIRPORT AREA TO CAMBRIA DRIVE AREA.....	25
	OPTION D1: LOW-LEVEL BRIDGE – AIRPORT AREA.....	28
	OPTION D2: LOW-LEVEL MOVEABLE BRIDGE – AIRPORT AREA.....	3132
	OPTION E: TUNNEL – JEFFERSON STREET	3435
	OPTION E2: TUNNEL – AIRPORT AREA	3738
	OPTION F1: HIGH-LEVEL EAST BRIDGE/LOW-LEVEL WEST BRIDGE.....	4041
	PENNOCK ISLAND	4041
	OPTION F1: HIGH-LEVEL CABLE STAYED BRIDGE OVER	43
	EAST CHANNEL – PENNOCK ISLAND.....	43
	OPTION F2: TUNNEL UNDER EAST CHANNEL – PENNOCK ISLAND	46
	OPTION F3: HIGH-LEVEL BRIDGE OVER WEST CHANNEL –	49
	PENNOCK ISLAND	49
	OPTION G1: FERRY – REFUGE COVE	52
	OPTION G2: FERRY – PENINSULA POINT	55
	OPTION G3: FERRY – DOWNTOWN.....	58
	OPTION G4: FERRY – EXPANDED EXISTING	61
4.0	IDENTIFICATION OF REASONABLE ALTERNATIVES	64
4.1	Introduction	64
4.1.1	Consistency with the Purpose and Need Statement.....	64
4.1.2	Consideration of Cost Factors.....	65
4.1.3	Consideration of Environmental and Transportation Factors.....	66
4.2	Analysis of Alternatives	66
4.2.1	No Action Alternative.....	66
4.2.2	Option A: High-level Bridge – Refuge Cove Area.....	66
4.2.3	Option B: High-level Bridge – Peninsula Point Area	67
4.2.4	Option C1: High-level Bridge – Airport Area North.....	67
4.2.5	Option C2: High-level Bridge – Airport Area South.....	68
4.2.6	Option C3: Modified High-level Bridge – Airport Area to Signal Road.....	69
4.2.7	Option C4: Modified High-level Bridge – Airport Area to Cambria Drive Area.....	69
4.2.8	Option D1: Low-level Bridge – Airport Area	70
4.2.9	Option D2: Low-level Moveable Bridge – Airport Area.....	70
4.2.10	Option E: Tunnel – Jefferson Street.....	71



4.2.11	Option E2: Tunnel – Airport Area	72
4.2.12	Option F1: High-level East Bridge/Low-level West Bridge – Pennock Island	72
4.2.13	Option F1: High-level Cable Stayed Bridge over East Channel– Pennock Island	73
4.2.14	Option F2: Tunnel under East Channel – Pennock Island	74
4.2.15	Option F3: High-level Bridge over West Channel – Pennock Island	74
4.2.16	Option G1: Ferry – Refuge Cove.....	75
4.2.17	Option G2: Ferry – Peninsula Point.....	76
4.2.18	Option G3: Ferry – Downtown.....	77
4.2.19	Option G4: Ferry – Expanded Existing.....	78
4.3	Conclusion	79

Appendix A	Life Cycle Costs
Appendix B	Explanation of Methods Used to Determine Potential Impacts to Natural Resources from Gravina Access Project
Appendix C	Letter from the Federal Aviation Administration, John J. Schommer, Obstruction Evaluation Specialist, dated September 21, 2000
Appendix D	Travel Time Calculations



1.0 Introduction

To date, the Gravina Access Project has identified 18 build alternative concepts for crossing Tongass Narrows between Ketchikan (Revillagigedo Island) and Gravina Island in the Ketchikan Gateway Borough. These alternative concepts are based on previous studies, new engineering analysis, and the objectives in the purpose and need statement for the project. This report contains an analysis of the 18 Gravina Access Project alternatives and the no action alternative, and establishes a basis for determining which alternatives are reasonable and which should be eliminated from further evaluation. This document presents the alternatives recommended as reasonable and thus proposed for further study. The reasonable alternatives, along with the no action alternative, will be assessed further in the National Environmental Policy Act (NEPA) document being prepared for this project. The requirement to comply with NEPA results from the federal funding for the project.

This alternative evaluation involves examining each alternative in terms of: 1) its projected costs and whether they fall within a realistic range; 2) its consistency with the substance of the purpose and need statement; 3) its potential environmental effects; and 4) its potential transportation-related effects. A range of factors, or measures, has been identified to provide an objective and quantitative representation of each alternative with respect to these general categories. These “screening factors” are specific items that can be measured relative to each alternative. The screening factors were finalized after considerable review and discussion in two separate meetings with the Gravina Access Project Development Team. Details about the factors (i.e., what they represent, how they are defined, and how they are measured) are provided in Section 2.0. Information about each alternative, including the no action alternative, is presented in terms of these factors in a series of Alternative Fact Sheets in Section 3.0. The screening analysis and recommended reasonable alternatives are presented in Section 4.0. The Alaska Department of Transportation and Public Facilities (DOT&PF) intends to seek agency concurrence with these proposed reasonable alternatives.

2.0 Screening Factors

This section contains a description of each screening factor and how it is defined. These factors were first introduced to the Project Development Team (PDT) at its May 2000 meeting. At that meeting the PDT asked for expanded definitions of each of the factors, a description of how they were to be measured, and any underlying assumptions. This information was presented at the August 2000 PDT meeting. Based on the input at these two meetings, DOT&PF refined the screening factors. Specifically, DOT&PF added factors on project purpose and need and traffic impacts during construction, and made other minor refinements and clarifications.

The factors presented in this report are being used to identify the range of reasonable alternatives. DOT&PF will consider the full range of impacts for all of the reasonable alternatives within all of the impact categories required by NEPA and FHWA regulations in the NEPA document.



2.1 Cost Factors

Total Project Costs: The total estimated project costs include administration, design, construction, construction management, right of way, and contingencies for construction and environmental mitigation, based on conceptual design quantities and materials unit costs in Year 2003 dollars. In this analysis, a contingency of 35 percent is applied to all options. This amount of contingency does tend to overstate the cost of ferries and understate the cost of tunnel alternatives, but this does not have a substantial affect on the screening evaluation. The amounts of contingency will likely decrease as more information is generated during the engineering refinement of the reasonable alternatives.

Annual Operation and Maintenance Costs: These costs include current and estimated annual operating and maintenance costs expressed in Year 2003 dollars. Primary costs are for personnel and equipment to maintain any of the alternatives and the staff needed to operate the moveable bridge, tunnel, or ferry options. This factor also includes energy costs and normal maintenance activities. There is no revenue or income projected for any of the alternatives including the no action alternative. There has been no decision about the use of tolls or fares for any alternative at this time.

Lifecycle Costs: The lifecycle cost factor measures the overall estimated cost for a project during its lifetime, including initial construction costs and periodic operation and maintenance costs. The lifecycle costs presented in the fact sheets account for inflation and include a discount for the salvage value of facilities that have a usable life of over 50 years at the end of a 50-year evaluation period, in Year 2003 dollars. This factor also includes periodic major expenditures, such as expenses to re-engine the ferries at 25-year intervals, re-paving at 20-year intervals, and replacing electrical/mechanical tunnel equipment at 20-year intervals. Appendix A describes how lifecycle costs were derived for this evaluation.

2.2 Purpose and Need Factors

These factors evaluate the alternatives relative to the statement of purpose and need. Alternatives are evaluated on specific measures to help determine their consistency with the project purpose and, in turn, their reasonableness for further evaluation in the NEPA document. Alternatives that do not satisfy the purpose and need statement are not considered reasonable.

The purpose and need for the Gravina Access Project are described as follows:

Purpose

The purpose of this project is to improve surface transportation between Revillagigedo Island and Gravina Island.



Need

The need for improving access is threefold:

- To improve the convenience and reliability of access to Ketchikan International Airport for passengers, airport tenants, emergency personnel and equipment, and shipment of freight.
- To provide the Ketchikan Gateway Borough and its residents more reliable, efficient, convenient, and cost-effective access for vehicles, bicycles, and pedestrians to Borough lands and other developable or recreation lands on Gravina Island in support of the Borough's adopted land use plans.
- To promote environmentally sound, planned long-term economic development on Gravina Island.

Reliability of Access: Specific measures include hours of operation and waiting times, schedule frequency, potential closure/downtime, and potential restrictions to access. The ability of an alternative to accommodate oversized and overweight vehicles and vehicles carrying hazardous materials is described.

Efficiency and Convenience of Access to Borough Lands and Other Lands on Gravina Island: Efficiency and convenience are measured by the amount of time it will take for vehicles, pedestrians, and bicycles to get from key representative locations on Revilla Island to select lands on Gravina Island (lands presumably available for development or recreation, such as Borough, Trust Land Office, or private lands). [Note that access specifically to the airport is described in a separate factor.] Specific measures include one-way travel time to private land and Borough land on Gravina Island from: Ketchikan's central business district (CBD), defined as milepost zero of Tongass Avenue (i.e., the Federal Building); Carlanna Creek, the general location of the airport ferry/Alaska Marine Highway System (AMHS) terminal and the Alaska Marine Line docks; and Ward Cove, which is defined as the Ward Cove Post Office. Travel times for vehicles are based on vehicular speed at 8 km/hr (5 mph) below the posted speed limit. Pedestrian travel times assume a travel speed of 5 km/hr (3 mph), and bicycle travel times assume a travel speed of 16 km/hr (10 mph). The travel times for the ferry alternatives account for waiting time based on HDR's December 1999 survey of ferry passengers. In the case of Option G4, the travel time for the new ferry is reduced by 3 minutes under the assumption that the arrival/departure times for the existing ferry and the new ferry would be staggered, thereby reducing the total waiting time.

Convenience: Convenience is also indicated in the location of the takeoff point on Revilla Island. Takeoff points nearer to areas occupied by large portions of the population are considered to be more convenient to those populations. The specific measure used for this factor is the travel distance from various locations on Revilla to the takeoff point of the alternative on Revilla.



Convenience of Access to Ketchikan International Airport: This factor evaluates the convenience of getting to the airport for airport-specific trips. This factor measures one-way travel time from Saxman, the CBD, Carlanna Creek, Ward Cove, and Point Higgins to the airport. Travel time for emergency personnel and equipment are measured from the hospital to the airport and from the nearest fire department to the airport. Travel times for vehicles are based on vehicular speed at 8 km/hr (5 mph) below the posted speed limit, with the exception of travel times for emergency vehicles, which are based on vehicular speeds at the posted speed limit.

2.3 Physical Environmental Factors

Natural Resources Impacts from Construction: The impacts of construction on natural resources are summarized in terms of impacts to wetlands, marine habitat, and fish and wildlife habitat. Specific measures are described as follows (see Appendix B for a description of the methodology used to determine the amount of impacts to natural resources).

Wetlands: Types of wetlands that would be affected by the alternatives are identified in the *Preliminary Wetlands Analysis* memorandum. [See also 11x17 GIS map handout of Uplands and Wetlands.] Construction impacts to wetlands are assumed to occur along the length of roadway where the alignment crosses wetlands. For each option, this factor provides the areas of wetlands (by type) that would be affected by construction. Affected wetland areas were calculated using the length of roadway through mapped wetlands and average width of the proposed roadway [i.e., 39.93 m (131 ft)].

Eelgrass Beds: Construction impacts to eelgrass beds are assumed to occur within the footprint area of a structure (e.g., pier footing, ferry terminal, tunnel) that would be positioned within an eelgrass bed specifically noted in the *Phase I Marine Reconnaissance Technical Memorandum* for the Gravina Access Project. [See also 11x17 GIS map handout of Eelgrass Bed Locations.] For each option, this factor provides the areas of eelgrass beds that would be affected by construction.

Intertidal/Subtidal Habitat: Construction impacts to intertidal and subtidal areas are assumed to occur within the footprint area of a structure (e.g., pier footing, ferry terminal, tunnel) that would be positioned within intertidal and subtidal habitat identified in the *Phase I Marine Reconnaissance Technical Memorandum* for the Gravina Access Project. For each option, this factor provides the areas of intertidal and subtidal habitat that would be affected by construction.

Essential Fish Habitat: Essential fish habitat (EFH) includes those waters and substrate that are necessary to National Marine Fisheries Service managed fish for spawning, breeding, feeding, or growth to maturity. Construction impacts to EFH are assumed to occur where structure would be placed in intertidal and subtidal waters, estuarine wetlands, and anadromous streams (Note: riparian wetlands also provide EFH; however, no riparian wetlands were identified in the study area in this screening evaluation). For each option, this factor provides the areas of EFH that would be affected by construction.



Anadromous Streams: Construction impacts to anadromous fish considers the number of anadromous streams crossed by the alignment. Information regarding anadromous streams comes from Alaska Department of Fish and Game anadromous stream mapping. [See also 11x17 GIS map handout of Anadromous Streams.]

Natural Resources Impacts from Operation: This factor addresses maintenance and long-term use of the project facilities and considers the effects of roadway runoff, maintenance of mechanical equipment, ferry emissions, and the physical presence of on-land and in-water structures with respect to fish and wildlife habitat.

Section 4(f) Properties: Section 4(f) of the Department of Transportation Act of 1966 requires that “special effort be made to preserve the natural beauty of the countryside and public park and recreation lands, wildlife and waterfowl refuges, and historic sites” (49 USC Section 303). The intent of Section 4(f) and the policy of the U.S. Department of Transportation is to avoid public parks, recreation areas, refuges, and historic sites. The impacts of each alternative on Section 4(f) properties are summarized in terms of impacts to cultural resources and public parks, recreation areas, and wildlife/waterfowl refuges. Specific measures are described as follows.

Archaeological Resources: Impacts to cultural resources are based on the potential of the alignment to impact known archaeological resources (cultural resources) identified in the *Phase I Historic and Archaeological Sites Technical Memorandum* for the Gravina Access Project. [See also 11x17 GIS map handout of Cultural and Historical Sites.] These are properties potentially subject to the provisions of Section 106 of the National Historic Preservation Act. Archaeological sites crossed by or in proximity to the alignment are identified.

Historic Sites: Impacts to historic resources are based on the potential of the alignment to impact historic sites identified in the *Phase I Historic and Archaeological Sites Technical Memorandum* for the Gravina Access Project. [See also 11x17 GIS map handout of Cultural and Historical Sites.] These are properties potentially subject to the provisions of Section 106 of the National Historic Preservation Act. The historic sites crossed by or in proximity to the alignment are identified.

Public Park/Recreation Areas/Refuges: Impacts to public parks, recreation areas, and refuges are assumed to occur where the alignment crosses a public park, recreation area, or refuge.

Impacts to Land Use/Community Facilities: The impacts of each alternative on land use and community facilities are described as follows.

Existing Development: This factor identifies direct impacts to current land use on Revilla and Gravina as a result of the location of the alignment.

Community Facilities: This factor identifies direct impacts to community facilities, including schools, hospitals, municipal buildings, and parks.



Aesthetics: The visibility of proposed structures from downtown Ketchikan, Tongass Narrows, and/or Gravina Island are described. The compatibility of each structure with its surroundings, based on size, is also provided.

Subsistence: Impacts to subsistence are described in terms of whether an alternative would affect areas currently used for subsistence.

2.4 Transportation Factors

The impacts of each alternative on transportation are summarized in terms of impacts to vehicular transportation, marine transportation, and aviation. Specific measures are as follows.

Vehicular Traffic Impacts During Construction and Operation: This factor describes impacts during construction to vehicle travel in the vicinity of where the alternatives are located on Revilla Island. Impacts to vehicular traffic are based on existing average daily traffic on Tongass Avenue. This factor addresses impacts to facilities at the airport.

Marine Navigation During Construction: This factor describes impacts to marine navigation from construction in terms of the restriction on shipping activity at the crossing and the length of time that the restriction would occur. Navigation or schedule impacts specific to the existing airport ferry are described.

Marine Navigation During Operation: This factor describes impacts to marine navigation from operation of the particular alternative, including a description of the types of ships that would continue to pass through Tongass Narrows and the types of ships that would be restricted in movement through Tongass Narrows as a result of the alternative. In addition, this factor addresses the potential use of ferries for maritime search and rescue operations.

Aviation During Construction: This factor describes impacts to aviation from construction and the impacts to aviators from the presence of construction equipment, such as cranes, in or near Tongass Narrows.

Aviation During Operation: Impacts to aviation are described in terms of the effects on floatplane and helicopter operations, including obstruction of the waterway and airway, impacts to the floatplane base at the airport, and penetrations of aeronautical surfaces associated with Ketchikan International Airport (measured in meters/feet). The maximum height of the bridge options¹ is used as an indication of impacts to floatplane operations in Tongass Narrows. The Federal Aviation Administration (FAA) conducted aeronautical studies to characterize the effects

¹ For a conservative estimate of maximum bridge height, HDR assumed that the tallest structure on each bridge would be the bridge lighting fixtures which would reach a height of approximately 20 feet above the road surface of the bridge.



of bridge crossings (i.e., Options A, B, C1, C2, D1, D2, F1, and F2²) on air space associated with Ketchikan International Airport (see Appendix C)³.

Cumulative and Secondary Impacts (CSI) was suggested as a screening factor. At this stage of the Alternatives Development Process, information is not available to allow CSI to be used as an effective screening factor. CSI will be fully considered in the NEPA document.

3.0 Project Fact Sheets

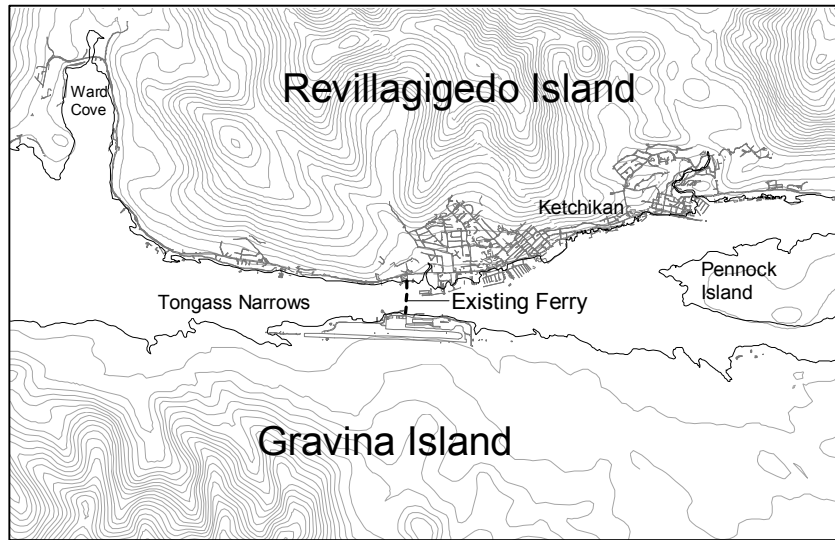
The following sections contain project fact sheets for each of the 18 build alternative concepts and the no action alternative. The fact sheets provide information developed for each of the screening factors for each of the crossing options. The information contained in the fact sheets provides the base of information upon which project team members determine the reasonableness of the option in Section 4.0.

² At the time of the FAA's investigation, Options C3, C4, and F3 had not been identified; however, based on current bridge design, the FAA findings for Options C3 and C4 would likely be the same as the findings for Option C2, and the findings for Option F3 would likely be the same as the findings for Options F1 and F2.

³ For purposes of its analysis, the FAA assumed that the lighting facilities on the bridge would be at or near the grade of the bridge and that the tallest bridge structure would be a 4.6-meter (15-foot) vehicle crossing the bridge.



NO ACTION ALTERNATIVE



The No Action Alternative would result in no new transportation access and no additional ferry service between Gravina Island and Revillagigedo Island. Access to Ketchikan International Airport and Gravina Island from Revillagigedo Island would continue to be possible from the existing ferry service, private boat, and floatplane. There is no construction associated with this alternative. The new ferry currently under construction for the existing ferry service would continue as planned under this alternative. It is assumed that the second ferry would need to be replaced in the year 2016.

Cost Factors

Total Project Costs	\$0
Annual Operation and Maintenance Costs	\$1.1 million
50-yr Lifecycle Costs	\$28 million

Purpose and Need Factors

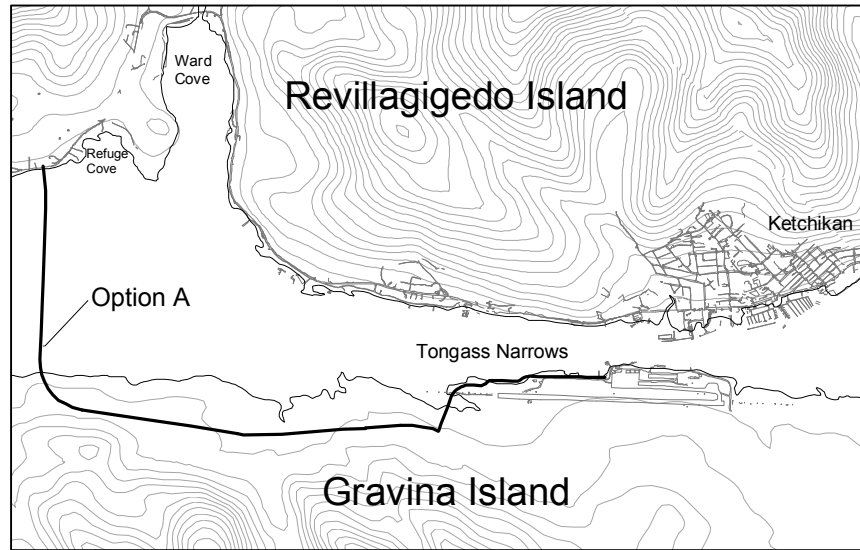
Reliability of Access	<u>Hours of Operation Per Day:</u> 16 (On occasion, wait times for ferry exceed 30 minutes because of peak ferry capacity.) <u>Schedule Frequency:</u> 30 minutes (winter), 15 minutes (summer 10am-5pm) <u>Closure/Downtime:</u> 8 hours per day (night); high winds/extreme weather, mechanical problems. <u>Restrictions to Access:</u> None.		
Efficiency and Convenience of Access to Borough and Other Lands on Gravina Island	<u>Travel Times (minutes)</u> CBD - Private Land: CBD – Borough Land: Carlanna Creek- Private Land: Carlanna Creek – Borough Land: Ward Cove – Private Land: Ward Cove – Borough Land:	<u>Vehicles</u> 	<u>Pedestrians</u> Not Applicable



Convenience	<u>Distance from Various Locations to the Takeoff Point on Revilla:</u> Downtown Saxman: 8.4 km (5.2 mi) Downtown Ketchikan: 4.5 km (2.8 mi) Carlanna Creek: 0.0 km (0.0 mi) Ward Cove: 7.2 km (4.5 mi) Point Higgins: 18.2 km (11.3 mi)
Convenience of Access to Ketchikan International Airport	<u>Vehicle Travel Times (minutes)</u> Saxman – Airport Terminal: 32 CBD – Airport Terminal: 27 Carlanna Creek – Airport Terminal: 19 Ward Cove – Airport Terminal: 25 Point Higgins – Airport Terminal: 34 <u>Emergency Vehicle Travel Times (minutes)</u> Hospital – Airport Terminal: 20 Fire Station – Airport Terminal: 20
Physical Environmental Factors	
Natural Resource Impacts from Construction	<u>Wetlands:</u> No effect. <u>Eelgrass Beds:</u> No effect. <u>Intertidal/Estuarine Habitat:</u> No effect. <u>Subtidal Habitat:</u> No effect. <u>Essential Fish Habitat:</u> No effect. <u>Anadromous Streams:</u> No effect.
Natural Resource Impacts from Operation	Ferry vessel emissions and maintenance activities could adversely affect marine resources.
Section 4(f) Properties	<u>Archaeological Resources:</u> No effect. <u>Historical Resources:</u> No effect. <u>Public Park/Recreation Areas/Refuges:</u> No effect.
Impacts to Land Use/Community Facilities	<u>Existing Development:</u> No effect. <u>Community Facilities:</u> No effect.
Aesthetics	No effect.
Subsistence	Research and outreach to date have not identified impacts to subsistence uses.
Transportation Factors	
Vehicular Traffic Impacts During Construction and Operation	No effect. Average Daily Traffic (1998) on Tongass Highway in the vicinity of the crossing is 9,672 vehicles.
Marine Navigation During Construction	No effect.
Marine Navigation During Operation	Potential conflicts between continued cross-channel ferry traffic and ships traveling through Tongass Narrows would continue.
Aviation Impacts During Construction	No effect.
Aviation Impacts During Operation	No effect.



OPTION A: HIGH-LEVEL BRIDGE – REFUGE COVE AREA



Option A is a high-level bridge that would start at approximately mile 8.5 of Tongass Avenue near Refuge Cove and would cross Tongass Narrows to Gravina Island approximately 4.3 km (2.7 mi) north of the airport. This bridge would provide a vertical clearance of 64 m (210 ft) and a horizontal clearance of 229 m (750 ft). The bridge would be about 2.4 km (1.5 mi) long, and it would connect with a roadway on Gravina Island that would extend to the airport.

Cost Factors

Total Project Costs	\$269 million
Annual Operation and Maintenance Costs	\$100,000
50-yr Lifecycle Costs	\$256 million

Purpose and Need Factors

Reliability of Access	Hours of Operation Per Day: 24 (No wait time is anticipated.)			
	<u>Schedule Frequency:</u> Unlimited			
	<u>Closure/Downtime:</u> Extreme high winds			
	<u>Restrictions to Access:</u> All vehicles would be permitted on the bridge and airport access road.			
Efficiency and Convenience of Access to Borough and Other Lands on Gravina Island	<u>Travel Times (minutes)</u>	<u>Vehicles</u>	<u>Pedestrians</u>	<u>Bicycles</u>
	CBD – Private Land:	18	197	60
	CBD – Borough Land:	18	200	61
	Carlanna Creek – Private Land:	10	142	43
	Carlanna Creek – Borough Land:	10	145	44
	Ward Cove – Private Land:	4	52	16
	Ward Cove – Borough Land:	4	55	17



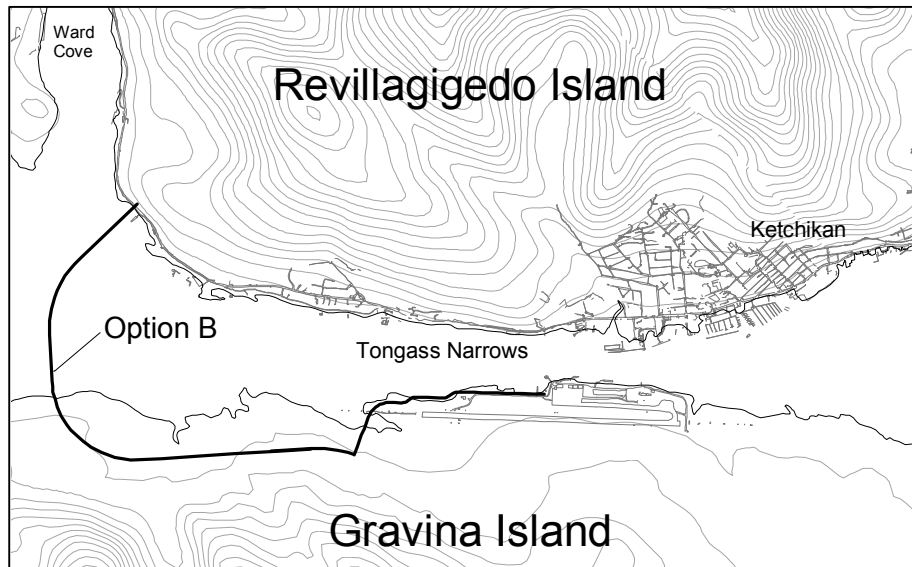
Convenience	<u>Distance from Various Locations to the Takeoff Point on Revilla:</u> Downtown Saxman: 17.7 km (11.0 mi) Downtown Ketchikan: 13.8 km (8.6 mi) Carlanna Creek: 9.3 km (5.8 mi) Ward Cove: 2.1 km (1.3 mi) Point Higgins: 8.9 km (5.5 mi)
Convenience of Access to Ketchikan International Airport	<u>Vehicle Travel Times (minutes)</u> Saxman – Airport Terminal: 30 CBD – Airport Terminal: 25 Carlanna Creek – Airport Terminal: 17 Ward Cove – Airport Terminal: 11 Point Higgins – Airport Terminal: 16 <u>Emergency Vehicle Travel Times (minutes)</u> Hospital – Airport Terminal: 16 Fire Station – Airport Terminal: 12
Physical Environmental Factors	
Natural Resource Impacts from Construction	<u>Wetlands/Estuaries:</u> Approx. 182,680 m ² (45.1 ac) of palustrine wetlands and 4,450 m ² (1.1 ac) of estuarine wetlands would be affected on Gravina Island [approx. 187,140 m ² (46.2 ac) total]. <u>Eelgrass Beds:</u> Approx. 80 m ² (0.02 ac) of sparse eelgrass beds would be affected. <u>Intertidal Habitat:</u> Since this option crosses near small islands in Tongass Narrows, more intertidal areas would be affected by bridge construction than would be affected at other crossing locations. Approx. 3,560 m ² (0.9 ac) of undisturbed intertidal habitat would be affected. <u>Subtidal Habitat:</u> Approx. 3,560 m ² (0.9 ac) of subtidal habitat would be affected. <u>Essential Fish Habitat:</u> Approx. 12,020 m ² (3.0 ac) of EFH would be affected. <u>Anadromous Streams:</u> Two anadromous streams would be crossed.
Natural Resource Impacts from Operation	Maintenance and long-term use of the roadway on Gravina Island would adversely affect wetlands and intertidal areas as a result of runoff. The roadway also would affect use of Gravina Island wetlands by land mammals and birds. Shading by a bridge would negatively affect eelgrass beds and intertidal areas. Bridge piers would affect juvenile fish movement in nearshore areas, particularly in the vicinity of Refuge Cove.
Section 4(f) Properties	<u>Archaeological Resources:</u> The alignment would be near, but would not directly affect, a small shell midden (KET-303). The National Register eligibility of this site has yet to be determined. <u>Historical Resources:</u> No known effect. <u>Public Park/Recreation Areas/Refuges:</u> The bridge alignment would pass through lands included in Refuge Cove State Park, a Section 4(f) property, on Revillagiedo Island. No other such properties would be affected.
Impacts to Land Use/Community Facilities	<u>Existing Development:</u> The bridge alignment would cross over or very close to small, privately owned islands, some of which are used for private residences. The bridge structure would adversely affect the quality of these islands for residential use. <u>Community Facilities:</u> Refuge Cove State Park would be altered by bridge development.



Aesthetics	The bridge would introduce a new, highly visible structure in an area currently dominated by smaller scale, man-made structures and natural features. As the only structure crossing Tongass Narrows, and at a height of approx. 76 m (250 ft), the bridge would become a dominant feature in the Ketchikan landscape.
Subsistence	Research and outreach to date have not identified impacts to subsistence uses.
Transportation Factors	
Vehicular Transportation During Construction	There is a potential for construction delays to traffic on Tongass Highway near Refuge Cove. Average Daily Traffic (1998) on Tongass Highway in the vicinity of the crossing is 5,642 vehicles. This alternative would affect parking, circulation, and utility requirements at the airport; however, the type and magnitude of the impacts cannot be characterized at this stage of the evaluation.
Marine Navigation During Construction	Most of the channel would be open during construction, except for the immediate area around the work barges. The existing ferry service would not be affected by construction.
Marine Navigation During Operation	Vessels would be limited to 229 m (750 ft) horizontal and 64 m (210 ft) vertical clearances. The airport ferry would be eliminated, which would have a positive effect on navigation in Tongass Narrows by reducing cross-channel ship traffic; however, the ferry would no longer be available as a possible search and rescue vessel.
Aviation Impacts During Construction	Floatplane operations would be affected by large cranes and other equipment in the channel.
Aviation Impacts During Operation	The bridge would not penetrate aeronautical surfaces or affect current or known future approaches associated with Ketchikan International Airport, but it would reach a height of approximately 76 m (250 ft), which would affect floatplane operations in Tongass Narrows.



OPTION B: HIGH-LEVEL BRIDGE – PENINSULA POINT AREA



Option B is a high-level bridge that would begin at approximately mile 5.5 of Tongass Avenue near Murphy's Landing and would cross Tongass Narrows to Gravina Island north of the Seeley Corporation timber processing plant. This bridge would provide a vertical clearance of 64 m (210 ft) and a horizontal clearance of 229 m (750 ft). The bridge would be approximately 2.3 km (1.4 mi) long, and it would connect with a roadway on Gravina Island that would extend to the airport.

Cost Factors

Total Project Costs	\$385 million
Annual Operation and Maintenance Costs	\$100,000
50-yr Lifecycle Costs	\$365 million

Purpose and Need Factors

Reliability of Access	Hours of Operation Per Day: 24 (No wait time is anticipated.) Schedule Frequency: Unlimited Closure/Downtime: Extreme high winds Restrictions to Access: All vehicles would be permitted on the bridge and airport access road.			
Efficiency and Convenience of Access to Borough and Other Lands on Gravina Island	<u>Travel Times (minutes)</u> CBD – Private Land: CBD – Borough Land: Carlanna Creek – Private Land: Carlanna Creek – Borough Land: Ward Cove – Private Land: Ward Cove – Borough Land:	<u>Vehicles</u> 14 14 6 6 4 4	<u>Pedestrians</u> 134 136 79 81 61 63	<u>Bicycles</u> 41 41 24 24 19 19



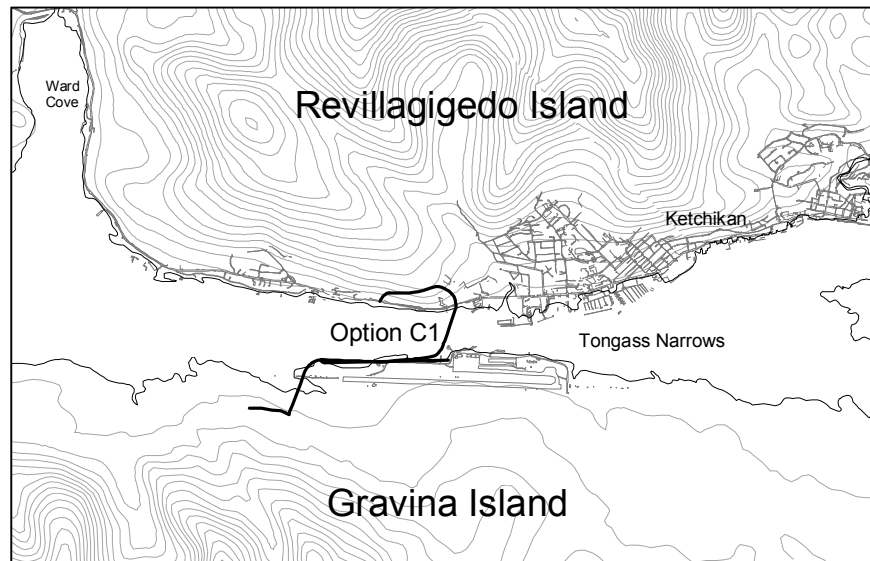
Convenience	<u>Distance from Various Locations to the Takeoff Point on Revilla:</u> Downtown Saxman: 12.7 km (7.9 mi) Downtown Ketchikan: 8.9 km (5.5 mi) Carlanna Creek: 4.3 km (2.7 mi) Ward Cove: 2.9 km (1.8 mi) Point Higgins: 13.8 km (8.6 mi)
Convenience of Access to Ketchikan International Airport	<u>Vehicle Travel Times (minutes)</u> Saxman – Airport Terminal: 24 CBD – Airport Terminal: 19 Carlanna Creek – Airport Terminal: 11 Ward Cove – Airport Terminal: 9 Point Higgins – Airport Terminal: 18 <u>Emergency Vehicle Travel Times (minutes)</u> Hospital – Airport Terminal: 11 Fire Station – Airport Terminal: 8
Physical Environmental Factors	
Natural Resource Impacts from Construction	<u>Wetlands/Estuaries:</u> Approx. 129,740 m ² (32.1 ac) of palustrine wetlands and 4,450 m ² (1.1 ac) of estuarine wetlands on Gravina Island would be affected [approx. 134,190 m ² (33.2 ac) total]. <u>Eelgrass Beds:</u> Approx. 240 m ² (0.06 ac) of sparse eelgrass bed would be affected. <u>Intertidal Habitat:</u> Approx. 890 m ² (0.2 ac) of undisturbed intertidal habitat and 890 m ² (0.2 ac) of armor rock (previously disturbed) intertidal area would be affected. <u>Subtidal Habitat:</u> Approx. 7,120 m ² (1.8 ac) of subtidal habitat would be affected. <u>Essential Fish Habitat:</u> Approx. 13,960 m ² (3.5 ac) of EFH would be affected. <u>Anadromous Streams:</u> Two anadromous streams would be crossed.
Natural Resource Impacts from Operation	Maintenance and long-term use of the roadway on Gravina Island would adversely affect wetlands and intertidal areas as a result of runoff. The roadway also would affect use of Gravina Island wetlands by land mammals. Shading by a bridge would negatively affect eelgrass beds and intertidal areas. Bridge piers would affect juvenile fish movement in nearshore areas.
Section 4(f) Properties	<u>Archaeological Resources:</u> No known effect. <u>Historical Resources:</u> The alignment would be near, but would not directly affect, the Port Gravina site (KET-027). The National Register eligibility of this site has yet to be determined. <u>Public Park/Recreation Areas/Refuges:</u> No effect.
Impacts to Land Use/Community Facilities	<u>Existing Development:</u> The alignment passes through an area presently used for moorage and vessel maintenance. <u>Community Facilities:</u> No effect.
Aesthetics	The bridge would introduce a new, highly visible structure in an area currently dominated by smaller scale, man-made structures and natural features. As the only structure crossing Tongass Narrows, and at a height of approx. 76 m (250 ft), the bridge would become a dominant feature in the Ketchikan landscape.
Subsistence	Research and outreach to date have not identified impacts to subsistence uses.



Transportation Factors	
Vehicular Traffic Impacts During Construction and Operation	There is a potential for construction delays to traffic on Tongass Highway near Murphy's Landing. Average Daily Traffic (1998) on Tongass Highway in the vicinity of the crossing is 7,720 vehicles. This alternative would affect parking, circulation, and utility requirements at the airport; however, the type and magnitude of the impacts cannot be characterized at this stage of the evaluation.
Marine Navigation During Construction	Most of the channel would be open during construction, except for the immediate area around the work barges. The existing airport ferry service would not be affected by construction.
Marine Navigation During Operation	Vessels would be limited to 229 m (750 ft) horizontal and 64 m (210 ft) vertical clearances. The airport ferry would be eliminated, which would have a positive effect on navigation in Tongass Narrows by reducing cross-channel ship traffic; however, the ferry would no longer be available as a possible search and rescue vessel.
Aviation Impacts During Construction	Floatplane operations would be affected by large cranes and other equipment in the channel.
Aviation Impacts During Operation	The bridge would not penetrate aeronautical surfaces or affect current or known future approaches associated with Ketchikan International Airport, but it would reach a height of approximately 76 m (250 ft), which would affect floatplane operations in Tongass Narrows.



OPTION C1: HIGH-LEVEL BRIDGE – AIRPORT AREA NORTH



Option C1 is a high-level bridge that would connect to Tongass Avenue north of the existing ferry slip, rise along the hillside behind the quarry, turn westward to cross over Tongass Avenue and Tongass Narrows, and then turn northward to parallel the airport runway as it descends. Option C1 would provide a vertical navigational clearance of 64 m (210 ft) and horizontal clearance of 229 m (750 ft). The bridge would be approximately 2.7 km (1.7 mi) long. The road would terminate at the boundary between the Airport Reserve and the Airport Development Zone and would include an exit to the airport terminal.

Cost Factors

Total Project Costs	\$242 million
Annual Operation and Maintenance Costs	\$100,000
50-yr Lifecycle Costs	\$231 million

Purpose and Need Factors

Reliability of Access	Hours of Operation Per Day: 24 (No wait time is anticipated.)			
	Schedule Frequency: Unlimited			
	Closure/Downtime: Extreme high winds			
	Restrictions to Access: All vehicles would be permitted on the bridge and airport access road.			
Efficiency and Convenience of Access to Borough and Other Lands on Gravina Island	<u>Travel Times (minutes)</u>	<u>Vehicles</u>	<u>Pedestrians</u>	<u>Bicycles</u>
	CBD – Private Land:	14	146	44
	CBD – Borough Land:	15	154	47
	Carlanna Creek – Private Land:	6	91	27
	Carlanna Creek – Borough Land:	7	99	30
	Ward Cove – Private Land:	10	155	46
	Ward Cove – Borough Land:	11	163	49



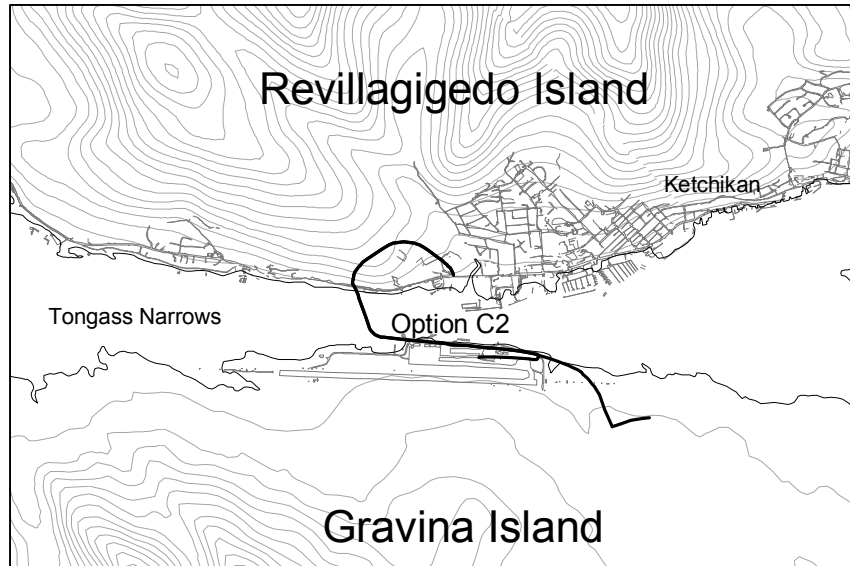
Convenience	<u>Distance from Various Locations to the Takeoff Point on Revilla:</u> Downtown Saxman: 9.3 km (5.8 mi) Downtown Ketchikan: 5.5 km (3.4 mi) Carlanna Creek: 1.1 km (0.7 mi) Ward Cove: 6.3 km (3.9 mi) Point Higgins: 17.1 km (10.6 mi)
Convenience of Access to Ketchikan International Airport	<u>Vehicle Travel Times (minutes)</u> Saxman – Airport Terminal: 19 CBD – Airport Terminal: 14 Carlanna Creek – Airport Terminal: 6 Ward Cove – Airport Terminal: 10 Point Higgins – Airport Terminal: 19 <u>Emergency Vehicle Travel Times (minutes)</u> Hospital – Airport Terminal: 6 Fire Station – Airport Terminal: 6
Physical Environmental Factors	
Natural Resource Impacts from Construction	<u>Wetlands/Estuaries:</u> Approx. 28,350 m ² (7.0 ac) of palustrine wetlands and 4,450 m ² (1.1 ac) of estuarine wetlands on Gravina Island would be affected [approx. 32,800 m ² (8.1 ac) total]. <u>Eelgrass Beds:</u> Approx. 3,560 m ² (0.9 ac) of dense eelgrass bed would be affected. <u>Intertidal Habitat:</u> Approx. 3,560 m ² (0.9 ac) of armor rock (previously disturbed) intertidal area would be affected. <u>Subtidal Habitat:</u> Approx. 8,010 m ² (2.0 ac) of somewhat productive (based on underwater survey) subtidal habitat would be affected. <u>Essential Fish Habitat:</u> Approx. 19,590 m ² (4.8 ac) of EFH would be affected. <u>Anadromous Streams:</u> No anadromous streams would be crossed.
Natural Resource Impacts from Operation	The bridge structure on Gravina Island would shadow intertidal habitat and eelgrass beds and change intertidal areas not already affected by airport development. Bridge piers may affect juvenile fish movement in nearshore areas, particularly where the structure parallels the shore. Maintenance and long-term use of the bridge and roadway would adversely affect marine resources as a result of runoff.
Section 4(f) Properties	<u>Archaeological Resources:</u> No known effect. <u>Historical Resources:</u> The alignment would be near, but would not directly affect, the Port Gravina site (KET-027). The National Register eligibility of this site has yet to be determined. <u>Public Park/Recreation Areas/Refuges:</u> No effect.
Impacts to Land Use/Community Facilities	<u>Existing Development:</u> No effect. <u>Community Facilities:</u> No effect.
Aesthetics	The bridge would introduce a new, highly visible structure in an area currently dominated by smaller scale, man-made structures and natural features. As the only structure crossing Tongass Narrows, and at a height of approx. 76 m (250 ft), the bridge would become a dominant feature in the Ketchikan landscape.
Subsistence	Research and outreach to date have not identified impacts to subsistence uses.



Transportation Factors	
Vehicular Traffic Impacts During Construction and Operation	There is a potential for construction delays to traffic on Tongass Avenue near the existing airport ferry. Average Daily Traffic (1998) on Tongass Avenue in the vicinity of the crossing is 9,672 vehicles. This alternative would affect parking, circulation, and utility requirements at the airport; however, the type and magnitude of the impacts cannot be characterized at this stage of the evaluation.
Marine Navigation During Construction	Most of the channel would be open during construction, except for the area immediately around the work barges. Construction in or near the main channel may have to be suspended during the cruise ship season. The existing airport ferry service may be affected by construction.
Marine Navigation During Operation	Vessels would be limited to 229 m (750 ft) horizontal and 64 m (210 ft) vertical clearances. The airport ferry would be eliminated, which would have a positive effect on navigation in Tongass Narrows by reducing cross-channel ship traffic; however, the ferry would no longer be available as a possible search and rescue vessel.
Aviation Impacts During Construction	Large cranes would extend into the airports aeronautical surfaces by at least 43 m (140 ft). Cranes and other equipment in the channel would affect floatplane operations.
Aviation Impacts During Operation	The bridge would penetrate the horizontal surface of Ketchikan International Airport by approximately 13 m (42 ft) and the transitional surface by approximately 29 m (95 ft), assuming a vehicle height of 4.6 m (15 ft). Although it would not affect current instrument procedures, Option C1 would prevent future reductions in approach minimums. Impacts to the aeronautical surfaces could be mitigated through appropriate markings and bridge lighting. This bridge would affect floatplane operations because it would reach a height of approximately 76 m (250 ft) over Tongass Narrows and would be aligned over the existing floatplane base at the airport.



OPTION C2: HIGH-LEVEL BRIDGE – AIRPORT AREA SOUTH



Option C2 is a high-level bridge that would start at Tongass Avenue south of the airport ferry terminal and rise northward along the hillside behind the quarry. It would then turn westward to cross Tongass Avenue and Tongass Narrows, and then turn southward to parallel the runway. Option C2 would provide a vertical navigational clearance of 64 m (210 ft) and a horizontal clearance of 229 m (750 ft). The bridge would be approximately 2.4 km (1.5 mi) long. The road would terminate at the boundary between the Airport Reserve and the Airport Development Zone and would include an exit to the airport terminal.

Cost Factors

Total Project Costs	\$205 million
Annual Operation and Maintenance Costs	\$100,000
50-yr Lifecycle Costs	\$197 million

Purpose and Need Factors

Reliability of Access	<u>Hours of Operation Per Day:</u> 24 (No wait time is anticipated.)			
	<u>Schedule Frequency:</u> Unlimited			
	<u>Closure/Downtime:</u> Extreme high winds			
	<u>Restrictions to Access:</u> All vehicles would be permitted on the bridge and airport access road.			
Efficiency and Convenience of Access to Borough and Other Lands on Gravina Island	<u>Travel Times (minutes)</u>	<u>Vehicles</u>	<u>Pedestrians</u>	<u>Bicycles</u>
	CBD – Private Land:	12	110	34
	CBD – Borough Land:	14	135	41
	Carlanna Creek – Private Land:	4	59	18
	Carlanna Creek – Borough Land:	6	84	25
	Ward Cove – Private Land:	10	149	45
	Ward Cove – Borough Land:	12	174	52



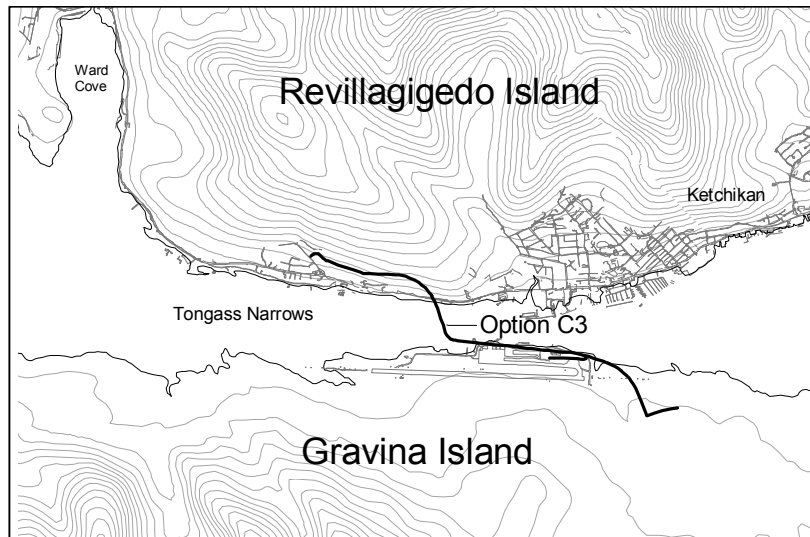
Convenience	<u>Distance from Various Locations to the Takeoff Point on Revilla:</u> Downtown Saxman: 8.2 km (5.1 mi) Downtown Ketchikan: 4.3 km (2.7 mi) Carlanna Creek: 0.2 km (0.1 mi) Ward Cove: 7.4 km (4.6 mi) Point Higgins: 18.3 km (11.4 mi)
Convenience of Access to Ketchikan International Airport	<u>Vehicle Travel Times (minutes)</u> Saxman – Airport Terminal: 18 CBD – Airport Terminal: 13 Carlanna Creek – Airport Terminal: 5 Ward Cove – Airport Terminal: 11 Point Higgins – Airport Terminal: 20 <u>Emergency Vehicle Travel Times (minutes)</u> Hospital – Airport Terminal: 5 Fire Station – Airport Terminal: 5
Physical Environmental Factors	
Natural Resource Impacts from Construction	<u>Wetlands/Estuaries:</u> Approx. 27,170 m ² (6.7 ac) of palustrine wetlands and 4,250 m ² (1.1 ac) of estuarine wetlands on Gravina Island would be affected [approx. 31,410 m ² (7.8 ac) total]. <u>Eelgrass Beds:</u> Approx. 1,780 m ² (0.4 ac) of dense eelgrass bed would be affected. <u>Intertidal Habitat:</u> Approx. 1,780 m ² (0.4 ac) of armor rock (previously disturbed) intertidal area would be affected. <u>Subtidal Habitat:</u> Approx. 2,670 m ² (0.7 ac) of subtidal habitat would be affected. <u>Essential Fish Habitat:</u> Approx. 10,480 m ² (2.5 ac) of EFH would be affected. <u>Anadromous Streams:</u> No anadromous streams would be crossed.
Natural Resource Impacts from Operation	Maintenance and long-term use of the bridge and roadway would adversely affect marine resources as a result of runoff. Shading by a bridge would negatively affect eelgrass beds and intertidal areas. Bridge piers may affect juvenile fish movement in near shore areas, particularly where the structure parallels the shore.
Section 4(f) Properties	<u>Archaeological Resources:</u> No effect. <u>Historical Resources:</u> No effect. <u>Public Park/Recreation Areas/Refuges:</u> No effect.
Impacts to Land Use/Community Facilities	<u>Existing Development:</u> The alignment would be located east of the quarry. A major change to the access to the Cambria neighborhood would be required. <u>Community Facilities:</u> No effect.
Aesthetics	The bridge would introduce a new, highly visible structure in an area currently dominated by smaller scale, man-made structures and natural features. As the only structure crossing Tongass Narrows, and at a height of approx. 76 m (250 ft), the bridge would become a dominant feature in the Ketchikan landscape.
Subsistence	Research and outreach to date have not identified impacts to subsistence uses.



Transportation Factors	
Vehicular Traffic Impacts During Construction and Operation	There is a potential for construction delays to traffic on Tongass Avenue near the existing airport ferry terminal. Average Daily Traffic (1998) on Tongass Avenue in the vicinity of the crossing is 9,672 vehicles. This alternative would affect parking, circulation, and utility requirements at the airport; however, the type and magnitude of the impacts cannot be characterized at this stage of the evaluation.
Marine Navigation During Construction	Most of the channel would be open during construction, except for the area immediately around the work barges. Construction in or near the main channel may have to be suspended during the cruise ship season. The existing airport ferry service would be affected by construction activities near the ferry terminal.
Marine Navigation During Operation	Vessels would be limited to 229 m (750 ft) horizontal and 64 m (210 ft) vertical clearances. The airport ferry would be eliminated, which would have a positive effect on navigation in Tongass Narrows by reducing cross-channel ship traffic; however, the ferry would no longer be available as a possible search and rescue vessel.
Aviation Impacts During Construction	Large cranes would extend into the airport's aeronautical surfaces by at least 23 m (75 ft). Cranes and other equipment in the channel would affect floatplane operations.
Aviation Impacts During Operation	The bridge would penetrate the horizontal surface of Ketchikan International Airport by approximately 14 m (46 ft) and the transitional surface by approximately 25 m (82 ft), assuming a vehicle height of 4.6 m (15 ft). Although it would not affect current instrument procedures, Option C2 would prevent future reductions in approach minimums. Impacts to the aeronautical surfaces could be mitigated through appropriate markings and bridge lighting. This bridge would affect floatplane operations because it would reach a height of approximately 76 m (250 ft) over Tongass Narrows and would be aligned over the existing floatplane base at the airport.



OPTION C3: MODIFIED HIGH-LEVEL BRIDGE – AIRPORT AREA TO SIGNAL ROAD



Option C3 is a modified high-level bridge. The bridge would connect to Signal Road on Revillagigedo Island and would traverse the hillside and gain elevation southward, then turn southwestward to cross Tongass Avenue and Tongass Narrows, and then turn southward to parallel the airport runway and touch down south of the terminal. The vertical navigational clearance of the bridge would be 64 m (210 ft) and the main span horizontal clearance would be 168 m (550 ft). The bridge would be approximately 1.6 km (1.0 mi) long. The road would terminate at the boundary between the Airport Reserve and the Airport Development Zone and would include an exit to the airport terminal.

Cost Factors

Total Project Costs	\$146 million
Annual Operation and Maintenance Costs	\$100,000
50-yr Lifecycle Costs	\$140 million

Purpose and Need Factors

Reliability of Access	<u>Hours of Operation per Day:</u> 24 (No wait time is anticipated.) <u>Schedule Frequency:</u> Unlimited <u>Closure/Downtime:</u> Extreme high winds <u>Restrictions to Access:</u> All vehicles would be permitted on the bridge and airport access road.			
Efficiency and Convenience of Access to Borough and Other Lands on Gravina Island	<u>Travel Times (minutes)</u> CBD – Private Land: CBD – Borough Land: Carlanna Creek – Private Land: Carlanna Creek – Borough Land: Ward Cove – Private Land: Ward Cove – Borough Land:	<u>Vehicles</u> 16 18 8 10 10 12	<u>Pedestrians</u> 143 168 88 113 129 154	<u>Bicycles</u> 44 51 27 34 40 47



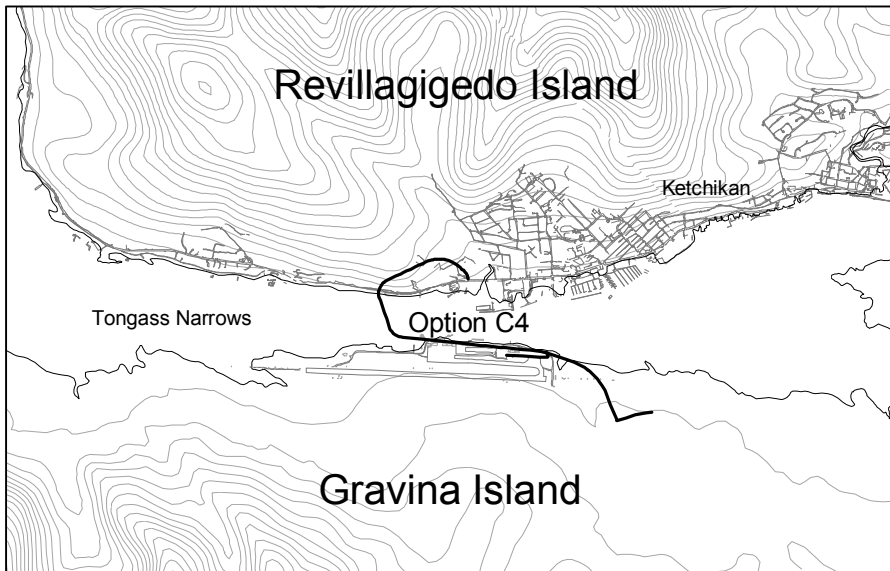
Convenience	<u>Distance from Various Locations to the Takeoff Point on Revilla:</u> Downtown Saxman: 10.3 km (6.4 mi) Downtown Ketchikan: 6.4 km (4.0 mi) Carlanna Creek: 1.9 km (1.2 mi) Ward Cove: 5.3 km (3.3 mi) Point Higgins: 16.3 km (10.1 mi)
Convenience of Access to Ketchikan International Airport	<u>Vehicle Travel Times (minutes)</u> Saxman – Airport Terminal: 21 CBD – Airport Terminal: 16 Carlanna Cr. – Airport Terminal: 8 Ward Cove – Airport Terminal: 10 Point Higgins – Airport Terminal: 19 <u>Emergency Vehicle Travel Times (minutes)</u> Hospital – Airport Terminal: 7 Fire Station – Airport Terminal: 6
Physical Environmental Factors	
Natural Resource Impacts from Construction	<u>Wetlands/Estuaries:</u> Approx. 27,170 m ² (6.7 ac) of palustrine wetlands and 4,250 m ² (1.1 ac) of estuarine wetlands on Gravina Island would be affected [approx. 31,410 m ² (7.8 ac) total]. <u>Eelgrass Beds:</u> Approx. 1,780 m ² (0.4 ac) of dense eelgrass bed would be affected. <u>Intertidal Habitat:</u> Approx. 1,780 m ² (0.4 ac) of armor rock (previously disturbed) intertidal area would be affected. <u>Subtidal Habitat:</u> Approx. 2,670 m ² (0.7 ac) of subtidal habitat would be affected. <u>Essential Fish Habitat:</u> Approx. 10,480 m ² (2.5 ac) of EFH would be affected. <u>Anadromous Streams:</u> No anadromous streams would be crossed.
Natural Resource Impacts from Operation	Maintenance and long-term use of the bridge and roadway would adversely affect marine resources as a result of runoff. Shading by a bridge would negatively affect eelgrass beds and intertidal areas. Bridge piers may affect juvenile fish movement in nearshore areas, particularly where the structure parallels the shore.
Section 4(f) Properties	<u>Archaeological Resources:</u> No effect. <u>Historical Resources:</u> No effect. <u>Public Park/Recreation Areas/Refuges:</u> No effect.
Impacts to Land Use/Community Facilities	<u>Existing Development:</u> Will increase traffic to an area of industrial/commercial development. <u>Community Facilities:</u> No effect.
Aesthetics	The bridge would introduce a new, highly visible structure in an area currently dominated by smaller scale, man-made structures and natural features. As the only structure crossing Tongass Narrows, and at a height of approx. 76 m (250 ft), the bridge would become a dominant feature in the Ketchikan landscape.
Subsistence	Research and outreach to date have not identified impacts to subsistence uses.



Transportation Factors	
Vehicular Traffic Impacts During Construction and Operation	There is a potential for construction delays to traffic on Tongass Avenue near the existing airport ferry. Average Daily Traffic (1998) on Tongass Avenue in the vicinity of the crossing is 9,672 vehicles. This alternative would affect parking, circulation, and utility requirements at the airport; however, the type and magnitude of the impacts cannot be characterized at this stage of the evaluation.
Marine Navigation During Construction	Most of the channel would be open during construction, except for the area immediately around the work barges. Construction in or near the main channel may have to be suspended during the cruise ship season. The existing airport ferry service would be affected by construction activities near the ferry terminal.
Marine Navigation During Operation	The U.S. Coast Guard would have to restrict marine traffic to one way for large ships passing under the bridge. Vessels would be limited to 168 m (550 ft) horizontal and 64 m (210 ft) vertical clearances. The airport ferry would be eliminated, which would have a positive effect on navigation in Tongass Narrows by reducing cross-channel ship traffic; however, the ferry would no longer be available as a possible search and rescue vessel.
Aviation Impacts During Construction	Large cranes would extend into the airport's aeronautical surfaces by at least 15 m (50 ft). Cranes and other equipment in the channel would affect floatplane operations.
Aviation Impacts During Operation	The bridge would penetrate the horizontal surface of Ketchikan International Airport by approximately 14 m (46 ft) and the transitional surface by approximately 25 m (82 ft), assuming a vehicle height of 4.6 m (15 ft). Although it would not affect current instrument procedures, Option C3 would prevent future reductions in approach minimums. Impacts to the aeronautical surfaces could be mitigated through appropriate markings and bridge lighting. This bridge would affect floatplane operations because it would reach a height of approximately 76 m (250 ft) over Tongass Narrows and would be aligned over the existing floatplane base at the airport.



OPTION C4: MODIFIED HIGH-LEVEL BRIDGE – AIRPORT AREA TO CAMBRIA DRIVE AREA



Option C4 is a modified high-level bridge. The bridge would connect to Tongass Avenue north of Cambria Drive and would continue northward, traversing the hillside around the quarry, crossing over Tongass Avenue and Tongass Narrows, and then turning southward to parallel the airport runway and touch down south of the terminal. This bridge option would provide a vertical navigation clearance of 64 m (210 ft) and a main span horizontal clearance of 168 m (550 ft). The bridge would be approximately 1.4 km (0.9 mi) long. The road would terminate at the boundary between the Airport Reserve and the Airport Development Zone and would include an exit to the airport terminal.

Cost Factors

Total Project Costs	\$153 million
Annual Operation and Maintenance Costs	\$100,000
50-yr Lifecycle Costs	\$147 million

Purpose and Need Factors

Reliability of Access	<u>Hours of Operation Per Day:</u> 24 (No wait time is anticipated.) <u>Schedule Frequency:</u> Unlimited <u>Closure/Downtime:</u> Extreme high winds <u>Restrictions to Access:</u> All vehicles would be permitted on the bridge and airport access road.			
Efficiency and Convenience of Access to Borough and Other Lands on Gravina Island	<u>Travel Times (minutes)</u> CBD – Private Land: CBD – Borough Land: Carlanna Creek – Private Land: Carlanna Creek – Borough Land: Ward Cove – Private Land: Ward Cove – Borough Land:	<u>Vehicles</u> 13 15 5 7 11 13	<u>Pedestrians</u> 107 132 56 81 146 171	<u>Bicycles</u> 33 40 17 24 44 51



Convenience	<u>Distance from Various Locations to the Takeoff Point on Revilla:</u> Downtown Saxman: 8.2 km (5.1 mi) Downtown Ketchikan: 4.3 km (2.7 mi) Carlanna Creek: 0.2 km (0.1 mi) Ward Cove: 7.4 km (4.6 mi) Point Higgins: 18.3 km (11.4 mi)
Convenience of Access to Ketchikan International Airport	<u>Vehicle Travel Times (minutes)</u> Saxman – Airport Terminal: 19 CBD – Airport Terminal: 14 Carlanna Creek – Airport Terminal: 6 Ward Cove – Airport Terminal: 12 Point Higgins – Airport Terminal: 21 <u>Emergency Vehicle Travel Times (minutes)</u> Hospital – Airport Terminal: 6 Fire Station – Airport Terminal: 6
Physical Environmental Factors	
Natural Resource Impacts from Construction	<u>Wetlands/Estuaries:</u> Approx. 27,170 m ² (6.7 ac) of palustrine wetlands and 3,030 m ² (0.8 ac) of estuarine wetlands on Gravina Island would be affected [approx. 30,200 m ² (7.5 ac) total]. <u>Eelgrass Beds:</u> Approx. 1,780 m ² (0.4 ac) of dense eelgrass bed would be affected. <u>Intertidal Habitat:</u> Approx. 1,780 m ² (0.4 ac) of armor rock (previously disturbed) intertidal area would be affected. <u>Subtidal Habitat:</u> Approx. 2,670 m ² (0.7 ac) of subtidal habitat would be affected. <u>Essential Fish Habitat:</u> Approx. 9,260 m ² (2.2 ac) of EFH would be affected. <u>Anadromous Streams:</u> No anadromous streams would be crossed.
Natural Resource Impacts from Operation	Maintenance and long-term use of the bridge and roadway would adversely affect resources as a result of runoff. Shading by a bridge would negatively affect eelgrass beds and intertidal areas. Bridge piers may affect juvenile fish movement in nearshore areas, particularly where the structure parallels the shore.
Section 4(f) Properties	<u>Archaeological Resources:</u> No effect. <u>Historical Resources:</u> No effect. <u>Public Park/Recreation Areas/Refuges:</u> No effect.
Impacts to Land Use/Community Facilities	<u>Existing Development:</u> The alignment eastward of the quarry would require modification of quarry operations. A minor change to the access to the Cambria neighborhood would be required. <u>Community Facilities:</u> No effect.
Aesthetics	The bridge would introduce a new, highly visible structure in an area currently dominated by smaller scale, man-made structures and natural features. As the only structure crossing Tongass Narrows, and at a height of approx. 76 m (250 ft), the bridge would become a dominant feature in the Ketchikan landscape.
Subsistence	Research and outreach to date have not identified impacts to subsistence uses.



Transportation Factors	
Vehicular Traffic Impacts During Construction and Operation	There is a potential for construction delays to traffic on Tongass Avenue near the existing airport ferry. Average Daily Traffic (1998) on Tongass Avenue in the vicinity of the crossing is 9,672 vehicles. This alternative would affect parking, circulation, and utility requirements at the airport; however, the type and magnitude of the impacts cannot be characterized at this stage of the evaluation.
Marine Navigation During Construction	Most of the channel would be open during construction, except for the area immediately around the work barges. Construction in or near the main channel may have to be suspended during the cruise ship season. The existing airport ferry service would be affected by construction activities near the ferry terminal.
Marine Navigation During Operation	The U.S. Coast Guard would have to restrict marine traffic to one way for large ships passing under the bridge. Vessels would be limited to 168 m (550 ft) horizontal and 64 m (210 ft) vertical clearances. The airport ferry would be eliminated, which would have a positive effect on navigation in Tongass Narrows by reducing cross-channel ship traffic; however, the ferry would no longer be available as a possible search and rescue vessel.
Aviation Impacts During Construction	Large cranes would extend into the airport's aeronautical surfaces by at least 23 m (75 ft). Cranes and other equipment in the channel would affect floatplane operations.
Aviation Impacts During Operation	The bridge would penetrate the horizontal surface of Ketchikan International Airport by approximately 14 m (46 ft) and the transitional surface by approximately 25 m (82 ft), assuming a vehicle height of 4.6 m (15 ft). Although it would not affect current instrument procedures, Option C4 would prevent future reductions in approach minimums. Impacts to the aeronautical surfaces could be mitigated through appropriate markings and bridge lighting. This bridge would affect floatplane operations because it would reach a height of approximately 76 m (250 ft) over Tongass Narrows and would be aligned over the existing floatplane base at the airport.

OPTION D1: LOW-LEVEL BRIDGE – AIRPORT AREA



Option D1 is a low-level bridge that would provide navigational clearances of 37 m (120 ft) vertical and 152 m (500 ft) horizontal. The bridge would start at Tongass Avenue near the airport ferry terminal, rise along the hillside behind the quarry, turn westward to cross over Tongass Avenue and Tongass Narrows, and then turn northward to parallel the airport runway on Gravina Island. The bridge would be about 0.8 km (0.5 mi) long. The road would terminate at the boundary between the Airport Reserve and the Airport Development Zone and would include an exit to the airport terminal.

Cost Factors

Total Project Costs	\$89 million
Annual Operation and Maintenance Costs	\$80,000
50-yr Lifecycle Costs	\$86 million

Purpose and Need Factors

Reliability of Access	Hours of Operation Per Day: 24 (No wait time is anticipated.)			
	Schedule Frequency: Unlimited			
Efficiency and Convenience of Access to Borough and Other Lands on Gravina Island	Closure/Downtime: Extreme high winds			
	Restrictions to Access: All vehicles would be permitted on the bridge and airport access road.			
	<u>Travel Times (minutes)</u>	<u>Vehicles</u>	<u>Pedestrians</u>	<u>Bicycles</u>
	CBD – Private Land:	14	128	38
	CBD – Borough Land:	15	136	41
	Carlanna Creek – Private Land:	6	77	22
	Carlanna Creek – Borough Land:	7	85	25
	Ward Cove – Private Land:	12	167	49
	Ward Cove – Borough Land:	13	175	52



Convenience	<u>Distance from Various Locations to the Takeoff Point on Revilla:</u> Downtown Saxman: 8.2 km (5.1 mi) Downtown Ketchikan: 4.3 km (2.7 mi) Carlanna Creek: 0.2 km (0.1 mi) Ward Cove: 7.4 km (4.6 mi) Point Higgins: 18.3 km (11.4 mi)
Convenience of Access to Ketchikan International Airport	<u>Vehicle Travel Times (minutes)</u> Saxman – Airport Terminal: 16 CBD – Airport Terminal: 11 Carlanna Creek – Airport Terminal: 3 Ward Cove – Airport Terminal: 9 Point Higgins – Airport Terminal: 18 <u>Emergency Vehicle Travel Times (minutes)</u> Hospital – Airport Terminal: 3 Fire Station – Airport Terminal: 3
Physical Environmental Factors	
Natural Resource Impacts from Construction	<u>Wetlands/Estuaries:</u> Approx. 60,960 m ² (15.1 ac) of palustrine wetlands on Gravina Island would be affected. <u>Eelgrass Beds:</u> Approx. 890 m ² (0.2 ac) of dense eelgrass bed would be affected. <u>Intertidal Habitat:</u> Approx. 890 m ² (0.2 ac) of armor rock (previously disturbed) intertidal area would be affected. <u>Subtidal Habitat:</u> Approx. 1,780 m ² (0.4 ac) of somewhat productive (based on underwater survey) subtidal habitat would be affected. <u>Essential Fish Habitat:</u> Approx. 3,560 m ² (0.9 ac) of EFH would be affected. <u>Anadromous Streams:</u> No anadromous streams would be crossed.
Natural Resource Impacts from Operation	Maintenance and long-term use of the bridge and roadway would adversely affect marine resources as a result of runoff. Shading by a bridge would negatively affect eelgrass beds and intertidal areas. Bridge piers may affect juvenile fish movement in nearshore areas.
Section 4(f) Properties	<u>Archaeological Resources:</u> No known effect. <u>Historical Resources:</u> The alignment would be near, but would not directly affect, the Port Gravina site (KET-027). The National Register eligibility of this site has yet to be determined. <u>Public Park/Recreation Areas/Refuges:</u> No effect.
Impacts to Land Use/Community Facilities	<u>Existing Development:</u> No effect. <u>Community Facilities:</u> No effect.
Aesthetics	The bridge would introduce a new structure to the visual environment that would be comparable in scale to the other man-made structures in the area. As the only structure crossing Tongass Narrows, the bridge would become a dominant feature in the Ketchikan landscape.
Subsistence	Cruise ship traffic would increase in Nichols Passage, which could interfere with the use of that area for subsistence by the community of Metlakatla.



Transportation Factors	
Vehicular Traffic Impacts During Construction and Operation	There is a potential for construction delays to traffic on Tongass Avenue near the existing airport ferry. Average Daily Traffic (1998) on Tongass Avenue in the vicinity of the crossing is 9,672 vehicles. This alternative would affect parking, circulation, and utility requirements at the airport; however, the type and magnitude of the impacts cannot be characterized at this stage of the evaluation.
Marine Navigation During Construction	Most of the channel would be open to cruise ships during the early phases of construction, but movement of cruise ships through the channel would not be possible in later phases. Ferry and other ship traffic could continue through Tongass Narrows during all phases of construction. The existing airport ferry service may be affected by construction.
Marine Navigation During Operation	The low-level bridge would require cruise ships calling in Ketchikan to enter and leave from the south, which would increase cruise ship traffic in Nichols Passage. The bridge may not meet U.S. Coast Guard requirements of providing for reasonable navigation through Tongass Narrows. Vessels would be limited to 152 m (500 ft) horizontal and 37 m (120 ft) vertical clearances. The airport ferry would be eliminated, which would have a positive effect on navigation in Tongass Narrows by reducing cross-channel ship traffic; however, the ferry would no longer be available as a possible search and rescue vessel.
Aviation Impacts During Construction	Large cranes and other equipment in the channel would affect floatplane operations.
Aviation Impacts During Operation	The bridge would not penetrate aeronautical surfaces or affect current or known future approaches associated with Ketchikan International Airport. The bridge would extend over the floatplane base and would reach a height of approximately 46 m (150 ft), which would affect floatplane operations in Tongass Narrows..



OPTION D2: LOW-LEVEL MOVEABLE BRIDGE – AIRPORT AREA



Option D2 is a low-level moveable bridge. The bridge would start at Tongass Avenue near the airport ferry terminal, rise along the hillside behind the quarry, turn westward to cross over Tongass Avenue and Tongass Narrows, and then turn northward to parallel the airport runway on Gravina Island. The bridge would incorporate a lift span over the main channel with a horizontal clearance of 229 m (750 ft) and a vertical clearance of 37 m (120 ft) in the closed position. When the lift span is raised, the bridge would provide a vertical clearance of 64 m (210 ft). The bridge would be approximately 0.8 km (0.5 mi) long. The road would terminate at the boundary between the Airport Reserve and the Airport Development Zone and would include an exit to the airport terminal.

Cost Factors

Total Project Costs	\$249 million
Annual Operation and Maintenance Costs	\$350,000
50-yr Lifecycle Costs	\$241 million

Purpose and Need Factors

Reliability of Access	<p><u>Hours of Operation Per Day:</u> 24, except when bridge is open for ship passage. (Wait times of up to 35 minutes anticipated.)</p> <p><u>Schedule Frequency:</u> Unscheduled openings based on vessel movements.</p> <p><u>Closure/Downtime:</u> Extreme high winds; up to 35 minutes of downtime for each cruise ship passage, 4-6 times per day in the summer; mechanical problems.</p> <p><u>Restrictions to Access:</u> All vehicles would be permitted on the bridge and airport access road.</p>
-----------------------	--



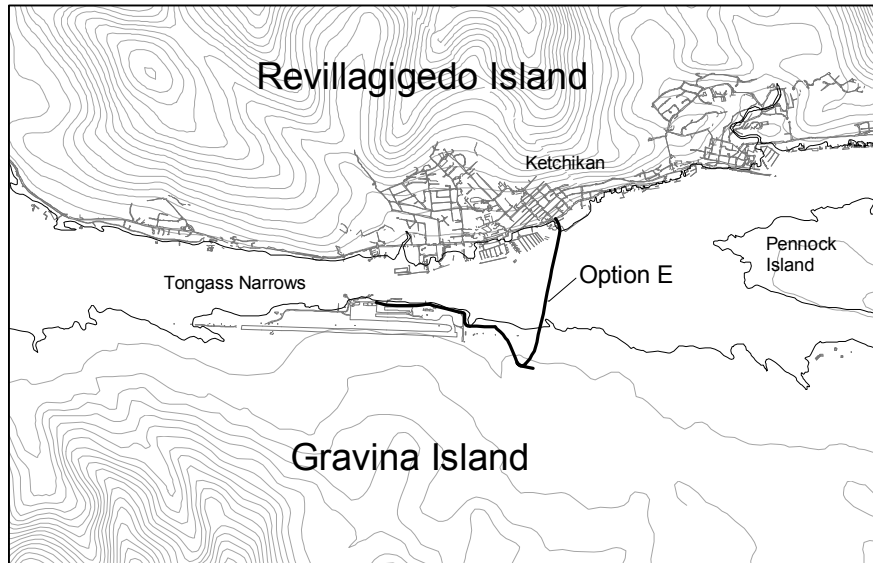
Efficiency and Convenience of Access to Borough and Other Lands on Gravina Island	<u>Travel Times (minutes)</u>	<u>Vehicles</u>	<u>Pedestrians</u>	<u>Bicycles</u>
	CBD – Private Land:	14	128	38
	CBD – Borough Land:	15	136	41
	Carlanna Creek – Private Land:	6	77	22
	Carlanna Creek – Borough Land:	7	85	25
	Ward Cove – Private Land:	12	167	49
	Ward Cove – Borough Land:	13	175	52
Convenience	<u>Distance from Various Locations to the Takeoff Point on Revilla:</u>			
	Downtown Saxman: 8.2 km (5.1 mi)			
	Downtown Ketchikan: 4.3 km (2.7 mi)			
	Carlanna Creek: 0.2 km (0.1 mi)			
	Ward Cove: 7.4 km (4.6 mi)			
Convenience of Access to Ketchikan International Airport	<u>Point Higgins: 18.3 km (11.4 mi)</u>			
	<u>Vehicle Travel Times (minutes)</u>			
	Saxman – Airport Terminal: 16			
	CBD – Airport Terminal: 11			
	Carlanna Creek – Airport Terminal: 3			
	Ward Cove – Airport Terminal: 9			
	Point Higgins – Airport Terminal: 18			
Physical Environmental Factors	<u>Emergency Vehicle Travel Times (minutes)</u>			
	Hospital – Airport Terminal: 3			
	Fire Station – Airport Terminal: 3			
Natural Resource Impacts from Construction	<u>Wetlands/Estuaries:</u> Approx. 60,960 m ² (15.1 ac) of palustrine wetlands on Gravina Island would be affected.			
	<u>Eelgrass Beds:</u> Approx. 890 m ² (0.2 ac) of dense eelgrass bed would be affected.			
	<u>Intertidal Habitat:</u> Approx. 890 m ² (0.2 ac) of armor rock (previously disturbed) intertidal area would be affected.			
	<u>Subtidal Habitat:</u> Approx. 1,780 m ² (0.4 ac) of somewhat productive (based on underwater survey) subtidal habitat would be affected.			
	<u>Essential Fish Habitat:</u> Approx. 3,560 m ² (0.9 ac) of EFH would be affected.			
	<u>Anadromous Streams:</u> No anadromous streams would be crossed.			
Natural Resource Impacts from Operation	The lift span would require over-water maintenance activities, including cleaning, painting, and maintenance of mechanical and electrical equipment, which could adversely affect the marine environment's water quality.			
	Maintenance and long-term use of the roadway would adversely affect marine resources as a result of runoff. Shading by a bridge would negatively affect eelgrass beds and intertidal areas. Bridge piers may affect juvenile fish movement in near shore areas.			
Section 4(f) Properties	<u>Archaeological Resources:</u> No known effect.			
	<u>Historical Resources:</u> The alignment would be near, but would not directly affect, the Port Gravina site (KET-027). The National Register eligibility of this site has yet to be determined.			
	<u>Public Park/Recreation Areas/Refuges:</u> No effect.			
Impacts to Land Use/Community Facilities	<u>Existing Development:</u> No effect.			
	<u>Community Facilities:</u> No effect.			



Aesthetics	The bridge would introduce a new structure to the visual environment that would be partially compatible with the scale of other man-made structures in the area. The towers and raised lift span would provide architectural interest, but would not be compatible with the smaller structures in the area. As the only structure crossing Tongass Narrows, and with the towers for the lift span, the bridge would become a dominant feature in Ketchikan landscape.
Subsistence	Research and outreach to date have not identified impacts to subsistence uses.
Transportation Factors	
Vehicular Transportation During Construction	There is a potential for construction delays to traffic on Tongass Avenue near the existing airport ferry. Average Daily Traffic (1998) on Tongass Avenue in the vicinity of the crossing is 9,672 vehicles. This alternative would affect parking, circulation, and utility requirements at the airport; however, the type and magnitude of the impacts cannot be characterized at this stage of the evaluation.
Marine Navigation During Construction	Most of the channel would be open during construction, except for the area immediately around the work barges. Construction in or near the main channel may have to be suspended during cruise ship season. The existing airport ferry service may be affected by construction.
Marine Navigation During Operation	The bridge, when opened, would provide 229 m (750 ft) of horizontal and 64 m (210 ft) of vertical clearance for cruise ships. When the bridge is closed it would provide 229 m (750 ft) of horizontal and 37 m (120 ft) of vertical clearance. The airport ferry would be eliminated, which would have a positive effect on navigation in Tongass Narrows by reducing cross-channel ship traffic; however, the ferry would no longer be available as a possible search and rescue vessel.
Aviation Impacts During Construction	Large cranes would extend 21 m (70 ft) into the airport's aeronautical surfaces. Cranes and other equipment in the channel would affect floatplane operations.
Aviation Impacts During Operation	The lift span and towers would extend 20 m (66 ft) into the horizontal surface for Ketchikan International Airport. Although it would not affect current instrument procedures, Option D2 would prevent future reductions in approach minimums. Impacts to the aeronautical surfaces could be mitigated through appropriate markings and bridge lighting. This bridge would affect floatplane operations because the towers, and bridge when opened, would reach a height of approximately 91 m (300 ft) over Tongass Narrows and the bridge span would be aligned over the existing floatplane base at the airport.



OPTION E: TUNNEL – JEFFERSON STREET



Option E is a tunnel option that would start at Tongass Avenue and Jefferson Street next to the mall, descend below the water surface, and cross Tongass Narrows to Gravina Island via a sunken tube/tunnel. The tunnel would include a pedestrian walkway. Special monitoring and safety features would be designed for the tunnel. The tunnel itself would be about 2.1 km (1.3 mi) long. Ships would cross over the tunnel within a defined channel approximately 229 m (750 ft) wide, providing a minimum draft of 12 m (40 ft).

Cost Factors

Total Project Costs	\$256 million
Annual Operation and Maintenance Costs	\$2.8 million
50-yr Lifecycle Costs	\$294 million

Purpose and Need Factors

Reliability of Access	Hours of Operation Per Day: 24 (No wait time is anticipated.)			
	Schedule Frequency: Unlimited			
Efficiency and Convenience of Access to Borough and Other Lands on Gravina Island	Closure/Downtime: None			
	Restrictions to Access: Vehicles carrying hazardous materials and oversized/overweight vehicles would be prohibited in the tunnel.			
	<u>Travel Times (minutes)</u>	<u>Vehicles</u>	<u>Pedestrians</u>	<u>Bicycles</u>
	CBD – Private Land:	7	60	18
	CBD – Borough Land:	9	85	25
	Carlanna Creek – Private Land:	6	54	16
	Carlanna Creek – Borough Land:	8	79	23
	Ward Cove – Private Land:	12	144	43
	Ward Cove – Borough Land:	14	169	50

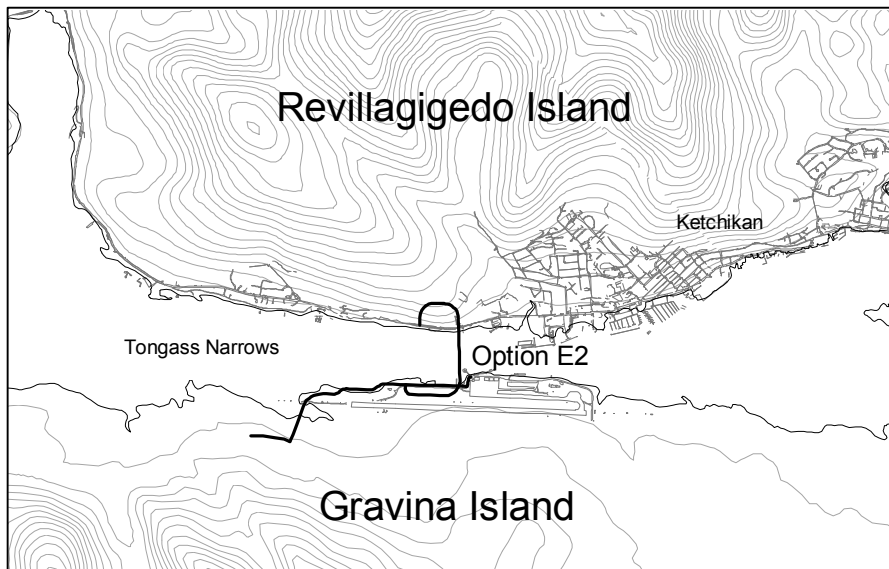


Convenience	<u>Distance from Various Locations to the Takeoff Point on Revilla:</u> Downtown Saxman: 6.4 km (4.0 mi) Downtown Ketchikan: 2.4 km (1.5 mi) Carlanna Creek: 1.9 km (1.2 mi) Ward Cove: 9.2 km (5.7 mi) Point Higgins: 20.1 km (12.5 mi)
Convenience of Access to Ketchikan International Airport	<u>Vehicle Travel Times (minutes)</u> Saxman – Airport Terminal: 15 CBD – Airport Terminal: 10 Carlanna Creek – Airport Terminal: 9 Ward Cove – Airport Terminal: 15 Point Higgins – Airport Terminal: 24 <u>Emergency Vehicle Travel Times (minutes)</u> Hospital – Airport Terminal: 6 Fire Station – Airport Terminal: 7
Physical Environmental Factors	
Natural Resource Impacts from Construction	<u>Wetlands/Estuaries:</u> Approx. 35,620 m ² (8.8 ac) of palustrine wetlands and 7,240 m ² (1.8 ac) of estuarine wetlands on Gravina Island would be affected [approx. 42,860 m ² (10.6 ac) total]. <u>Eelgrass Beds:</u> Approx. 40 m ² (0.01 ac) of sparse eelgrass bed would be affected. <u>Intertidal Habitat:</u> Approx. 890 m ² (0.2 ac) of undisturbed intertidal habitat and 890 m ² (0.2 ac) of armor rock (previously disturbed) intertidal area would be affected. <u>Subtidal Habitat:</u> Approx. 44,920 m ² (11.1 ac) of subtidal habitat would be affected. <u>Essential Fish Habitat:</u> Approx. 53,980 m ² (13.4 ac) of EFH would be affected. <u>Anadromous Streams:</u> No anadromous streams would be affected.
Natural Resource Impacts from Operation	Maintenance and long-term use of the roadway on Gravina Island would adversely affect wetlands as a result of runoff. The roadway also would affect use of the wetlands as habitat for land mammals on Gravina Island. The embankment over the tunnel may affect juvenile fish movement in nearshore areas.
Section 4(f) Properties	<u>Archaeological Resources:</u> No effect. <u>Historical Resources:</u> No effect. <u>Public Park/Recreation Areas/Refuges:</u> No effect.
Impacts to Land Use/Community Facilities	<u>Existing Development:</u> Development of a tunnel entrance at Jefferson Street and Tongass Avenue would require the removal of existing structures along the waterfront. <u>Community Facilities:</u> No effect.
Aesthetics	The tunnel and associated roadway approaches would have a minimal effect on the visual environment.
Subsistence	Research and outreach to date have not identified impacts to subsistence uses.



Transportation Factors	
Vehicular Traffic Impacts During Construction and Operation	There is a potential for construction delays to traffic on Tongass Avenue near its intersection with Jefferson. Average Daily Traffic (1998) on Tongass Avenue in the vicinity of the crossing is 20,245 vehicles. This alternative would affect parking, circulation, and utility requirements at the airport; however, the type and magnitude of the impacts cannot be characterized at this stage of the evaluation.
Marine Navigation During Construction	Most of the channel would be open during construction, except for the immediate area around the work barges. Construction in the main channel may have to be suspended during the cruise ship season. The existing airport ferry service may be affected by construction.
Marine Navigation During Operation	The airport ferry would be eliminated, which would have a positive effect on navigation in Tongass Narrows by reducing cross-channel ship traffic; however, the ferry would no longer be available as a possible search and rescue vessel.
Aviation Impacts During Construction	Floatplane operations would be affected by construction equipment in the channel.
Aviation Impacts During Operation	No effect.

OPTION E2: TUNNEL – AIRPORT AREA



Option E2 is a tunnel option that starts at Tongass Avenue north of the quarry, then enters the hillside in a bored tunnel, curving under Tongass Avenue and crossing under Tongass Narrows in a sunken tube. It then curves northward, reaching ground level next to the runway north of the terminal. Ships would cross over the tunnel within a defined channel approximately 229 m (750 ft) wide, providing a minimum draft of 12 m (40 ft). The tunnel would be about 1.38 km (0.86 mi) long, including a 0.72-km (0.45-mi) bored tunnel. The tunnel/sunken tube would include a pedestrian walkway. Special monitoring and safety features would be designed for the tunnel. The road would terminate at the boundary between the Airport Reserve and the Airport Development Zone and would include an exit to the airport terminal.

Total Project Costs	\$347 million			
Annual Operation and Maintenance Costs	\$2.9 million			
50-yr Lifecycle Costs	\$382 million			
Purpose and Need Factors				
Reliability of Access	<u>Hours of Operation Per Day:</u> 24 (No wait time is anticipated.) <u>Schedule Frequency:</u> Unlimited <u>Closure/Downtime:</u> None <u>Restrictions to Access:</u> Vehicles carrying hazardous materials and oversized/overweight vehicles would be prohibited in the tunnel.			
Efficiency and Convenience of Access to Borough and Other Lands on Gravina Island	<u>Travel Times (minutes)</u> CBD – Private Land: CBD – Borough Land: Carlanna Creek – Private Land: Carlanna Creek – Borough Land: Ward Cove – Private Land: Ward Cove – Borough Land:	<u>Vehicles</u> 15 16 7 8 11 12	<u>Pedestrians</u> 141 150 86 95 156 165	<u>Bicycles</u> 42 45 25 28 46 49



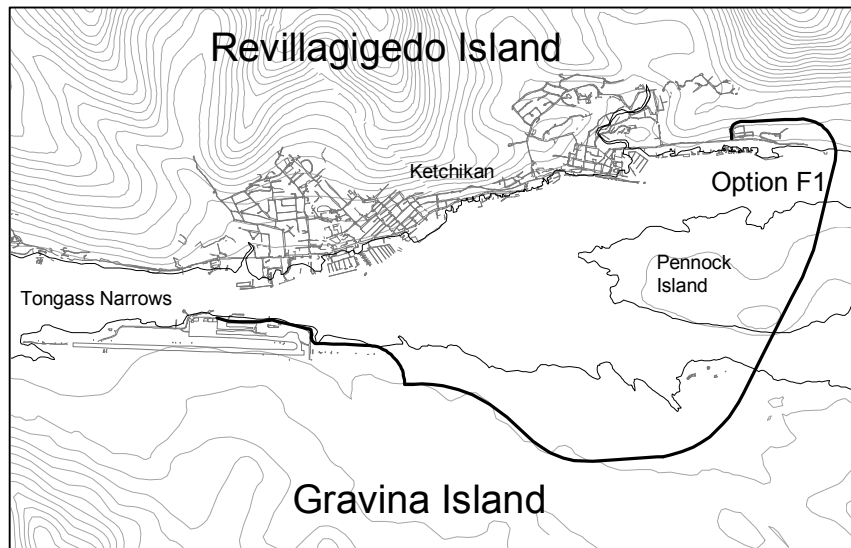
Convenience	<u>Distance from Various Locations to the Takeoff Point on Revilla:</u> Downtown Saxman: 9.2 km (5.7 mi) Downtown Ketchikan: 5.3 km (3.3 mi) Carlanna Creek: 0.8 km (0.5 mi) Ward Cove: 6.4 km (4.0 mi) Point Higgins: 17.3 km (10.8 mi)
Convenience of Access to Ketchikan International Airport	<u>Vehicle Travel Times (minutes)</u> Saxman – Airport Terminal: 17 CBD – Airport Terminal: 12 Carlanna Creek – Airport Terminal: 4 Ward Cove – Airport Terminal: 8 Point Higgins – Airport Terminal: 17 <u>Emergency Vehicle Travel Times (minutes)</u> Hospital – Airport Terminal: 5 Fire Station – Airport Terminal: 5
Physical Environmental Factors	
Natural Resource Impacts from Construction	<u>Wetlands/Estuaries:</u> Approx. 27,080 m ² (6.7 ac) of palustrine wetlands and 4,330 m ² (1.1 ac) of estuarine wetlands on Gravina Island would be affected [approx. 31,410 m ² (7.8 ac) total]. <u>Eelgrass Beds:</u> Approx. 890 m ² (0.2 ac) of eelgrass bed would be affected. <u>Intertidal Habitat:</u> Approx. 1,780 m ² (0.4 ac) of armor rock (previously disturbed) intertidal area would be affected. <u>Subtidal Habitat:</u> Approx. 26,990 m ² (6.7 ac) of subtidal habitat would be affected. <u>Essential Fish Habitat:</u> Approx. 34,000 m ² (8.4 ac) of EFH would be affected. <u>Anadromous Streams:</u> No anadromous streams would be crossed.
Natural Resource Impacts from Operation	Maintenance and long-term use of the tunnel would not significantly affect marine resources or other fish and wildlife habitat in the area. The embankment over the tunnel may affect juvenile fish movement in nearshore areas.
Section 4(f) Properties	<u>Archaeological Resources:</u> No known effect. <u>Historical Resources:</u> The alignment would be near, but would not directly affect, the Port Gravina site (KET-027). The National Register eligibility of this site has yet to be determined. <u>Public Park/Recreation Areas/Refuges:</u> No effect.
Impacts to Land Use/Community Facilities	<u>Existing Development:</u> No effect. <u>Community Facilities:</u> No effect.
Aesthetics	The tunnel and associated roadway approaches would have a minimal effect on the visual environment.
Subsistence	Research and outreach to date have not identified impacts to subsistence uses.



Transportation Factors	
Vehicular Traffic Impacts During Construction and Operation	No effect. Average Daily Traffic (1998) on Tongass Highway in the vicinity of the crossing is 9,672 vehicles. This alternative would affect parking, circulation, and utility requirements at the airport; however, the type and magnitude of the impacts cannot be characterized at this stage of the evaluation.
Marine Navigation During Construction	Most of the channel would be open during construction, except for the immediate area around the work barges. Construction in the main channel may have to be suspended during the cruise ship season. The existing airport ferry service may be affected by construction.
Marine Navigation During Operation	The airport ferry would be eliminated, which would have a positive effect on navigation in Tongass Narrows by reducing cross-channel ship traffic; however, the ferry would no longer be available as a possible search and rescue vessel.
Aviation Impacts During Construction	Floatplane operations would be affected by construction equipment in the channel.
Aviation Impacts During Operation	No effect.



OPTION F1: HIGH-LEVEL EAST BRIDGE/LOW-LEVEL WEST BRIDGE PENNOCK ISLAND



Option F1 is a high-level/low-level bridge option. The alignment would start at Tongass Avenue just north of the cemetery, rise to the south along the hillside behind the cemetery and the U.S. Coast Guard Base, and then turn westward and cross over Tongass Avenue and the east channel of Tongass Narrows to Pennock Island. This option would cross Pennock Island at grade and then use a second, low-level bridge to extend over the west channel of Tongass Narrows. The east channel bridge would provide 229 m (750 ft) horizontal and 64 m (210 ft) vertical clearances and the west channel bridge would provide 160 m (525 ft) horizontal and 37 m (120 ft) vertical clearances. The east channel and west channel bridges would be 1.3 and 0.6 km (0.8 and 0.4 mi) long, respectively.

Cost Factors

Total Project Costs	\$206 million
Annual Operation and Maintenance Costs	\$120,000
50-yr Lifecycle Costs	\$198 million

Purpose and Need Factors

Reliability of Access	<u>Hours of Operation Per Day:</u> 24 (No wait time is anticipated.) <u>Schedule Frequency:</u> Unlimited <u>Closure/Downtime:</u> Extreme high winds <u>Restrictions to Access:</u> All vehicles would be permitted on the bridges and airport access road.			
Efficiency and Convenience of Access to Borough and Other Lands on Gravina Island	<u>Travel Times (minutes)</u> CBD – Private Land: CBD – Borough Land: Carlanna Creek – Private Land: Carlanna Creek – Borough Land: Ward Cove – Private Land: Ward Cove – Borough Land:	<u>Vehicles</u> 6 7 14 15 20 21	<u>Pedestrians</u> 61 78 116 133 206 223	<u>Bicycles</u> 19 24 36 41 63 68

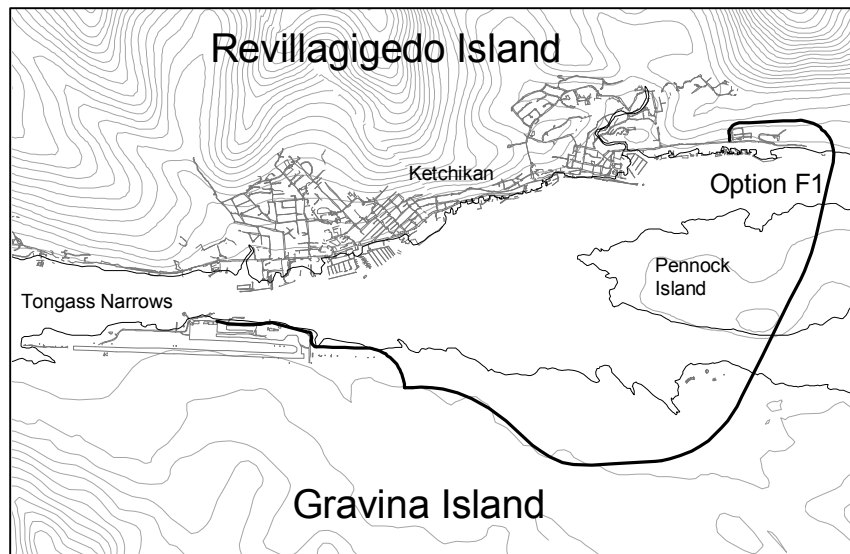


Convenience	<u>Distance from Various Locations to the Takeoff Point on Revilla:</u> Downtown Saxman: 2.7 km (1.7 mi) Downtown Ketchikan: 1.1 km (0.7 mi) Carlanna Creek: 5.6 km (3.5 mi) Ward Cove: 12.9 km (8.0 mi) Point Higgins: 23.8 km (14.8 mi)
Convenience of Access to Ketchikan International Airport	<u>Vehicle Travel Times (minutes)</u> Saxman – Airport Terminal: 14 CBD – Airport Terminal: 13 Carlanna Creek – Airport Terminal: 21 Ward Cove – Airport Terminal: 27 Point Higgins – Airport Terminal: 36 <u>Emergency Vehicle Travel Times (minutes)</u> Hospital – Airport Terminal: 16 Fire Station – Airport Terminal: 12
Physical Environmental Factors	
Natural Resource Impacts from Construction	<u>Wetlands/Estuaries Habitat:</u> Approx. 187,720 m ² (46.4 ac) of palustrine wetlands and 3,060 m ² (0.8 ac) of estuarine wetlands on Gravina Island would be affected [approx. 190,780 m ² (47.2 ac) total]. <u>Eelgrass Beds:</u> Eelgrass beds would be avoided. <u>Intertidal Habitat:</u> Approx. 2,670 m ² (0.7 ac) of undisturbed intertidal habitat and 890 m ² (0.2 ac) of armor rock (previously disturbed) intertidal area would be affected. <u>Subtidal Habitat:</u> Approx. 2,670 m ² (0.7 ac) of subtidal habitat would be affected. <u>Essential Fish Habitat:</u> Approx. 9,650 m ² (2.4 ac) of EFH would be affected. <u>Anadromous Streams:</u> Two anadromous streams would be crossed.
Natural Resource Impacts from Operation	Maintenance and long-term use of the roadway on Pennock and Gravina islands would adversely affect wetlands and intertidal areas as a result of runoff. The roadway also would affect use of the wetlands as habitat for animals on Pennock and Gravina islands. Shading by a bridge would negatively affect intertidal areas. Bridge piers may affect juvenile fish movement in nearshore areas.
Section 4(f) Properties	<u>Archaeological Resources:</u> The alignment could potentially cross burial grounds on Pennock Island that may be considered eligible for the National Register of Historic Places. <u>Historical Resources:</u> The alignment could affect the Headquarters Building of the 16 th Lighthouse District (KET-279) and the New England Fish Company cannery district (KET-492), both of which are on Revillagigedo Island. <u>Public Park/Recreation Areas/Refuges:</u> No effect.
Impacts to Land Use/Community Facilities	<u>Existing Development:</u> No effect. <u>Community Facilities:</u> The alignment is adjacent to the cemetery.
Aesthetics	The bridges would introduce new, highly visible structures in areas currently dominated by smaller scale, man-made structures and natural features. The bridges would become dominant features in the landscape.
Subsistence	This option would potentially disturb areas on Pennock Island that are used for subsistence and make these areas more accessible to the general population. This option would result in loss of subsistence resources.



Transportation Factors	
Vehicular Traffic Impacts During Construction and Operation	There is a potential for construction delays to traffic on Tongass Highway near the Coast Guard Base. Average Daily Traffic (1998) on Tongass Highway in the vicinity of the crossing is 4,602 vehicles. This alternative would affect parking, circulation, and utility requirements at the airport; however, the type and magnitude of the impacts cannot be characterized at this stage of the evaluation.
Marine Navigation During Construction	Most areas of the channels would be open during construction, except for the immediate area around the work barges. Ship traffic would be directed to the west channel while the high-level bridge is constructed in the east channel, thereby maintaining cruise ship passage throughout the construction period. The existing airport ferry service would not be affected by construction activities.
Marine Navigation During Operation	Vessels would be limited to 229 m (750 ft) horizontal and 64 m (210 ft) vertical clearances in the east channel, and 160 m (525 ft) horizontal and 37 m (120 ft) vertical clearances in the west channel. The airport ferry would be eliminated, which would have a positive effect on navigation in Tongass Narrows by reducing cross-channel ship traffic; however, the ferry would no longer be available as a possible search and rescue vessel.
Aviation Impacts During Construction	Floatplane operations would be affected by large cranes and other equipment in the east channel.
Aviation Impacts During Operation	The east channel is heavily used for floatplane operations. The height of the east channel bridge [about 76 m (250 ft)] would adversely affect floatplane operations in the east channel. Floatplane operations in the less-frequently-used west channel would be adversely affected by the 46-m (150-ft) bridge. Neither bridge would penetrate aeronautical surfaces or affect current or known future approaches associated with Ketchikan International Airport.

OPTION F1: HIGH-LEVEL CABLE STAYED BRIDGE OVER EAST CHANNEL – PENNOCK ISLAND



Option F1 is a high-level cable stayed bridge/low-level bridge option that would start at Tongass Avenue just north of the cemetery, rise along the hillside behind the cemetery and the U.S. Coast Guard Base, and then turn westward and cross over Tongass Avenue and the east channel of Tongass Narrows to Pennock Island. This option would cross Pennock Island at grade and then use a second, low-level bridge to extend over the west channel of Tongass Narrows. The east channel bridge would provide 229 m (750 ft) horizontal and 64 m (210 ft) vertical clearances and the west channel bridge would provide 160 m (525 ft) horizontal and 37 m (120 ft) vertical clearances. The east channel and west channel bridges would be 1.3 and 0.6 km (0.8 and 0.4 mi) long, respectively.

Cost Factors

Total Project Costs	\$211 million
Annual Operation and Maintenance Costs	\$210,000
50-yr Lifecycle Costs	\$204 million

Purpose and Need Factors

Reliability of Access	<u>Hours of Operation Per Day:</u> 24 (No wait time is anticipated.) <u>Schedule Frequency:</u> Unlimited <u>Closure/Downtime:</u> Extreme high winds <u>Restrictions to Access:</u> All vehicles would be permitted on the bridges and airport access road.			
Efficiency and Convenience of Access to Borough and Other Lands on Gravina Island	<u>Travel Times (minutes)</u>	<u>Vehicles</u>	<u>Pedestrians</u>	<u>Bicycles</u>
	CBD – Private Land:	6	61	19
	CBD – Borough Land:	7	78	24
	Carlanna Creek – Private Land:	14	116	36
	Carlanna Creek – Borough Land:	15	133	41
	Ward Cove – Private Land:	20	206	63
	Ward Cove – Borough Land:	21	223	68



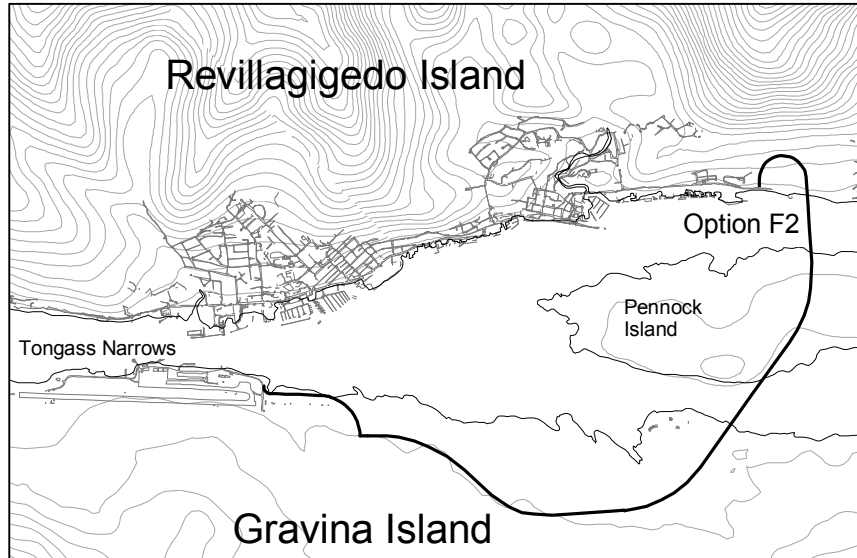
Convenience	<u>Distance from Various Locations to the Takeoff Point on Revilla:</u> Downtown Saxman: 2.7 km (1.7 mi) Downtown Ketchikan: 1.1 km (0.7 mi) Carlanna Creek: 5.6 km (3.5 mi) Ward Cove: 12.9 km (8.0 mi) Point Higgins: 23.8 km (14.8 mi)
Convenience of Access to Ketchikan International Airport	<u>Vehicle Travel Times (minutes)</u> Saxman – Airport Terminal: 14 CBD – Airport Terminal: 13 Carlanna Creek – Airport Terminal: 21 Ward Cove – Airport Terminal: 27 Point Higgins – Airport Terminal: 36 <u>Emergency Vehicle Travel Times (minutes)</u> Hospital – Airport Terminal: 16 Fire Station – Airport Terminal: 12
Physical Environmental Factors	
Natural Resource Impacts from Construction	<u>Wetlands/Estuaries Habitat:</u> Approx. 187,720 m ² (46.4 ac) of palustrine wetlands and 3,060 m ² (0.8 ac) of estuarine wetlands on Gravina Island would be affected [approx. 190,780 m ² (47.2 ac) total]. <u>Eelgrass Beds:</u> Eelgrass beds would be avoided. <u>Intertidal Habitat:</u> Approx. 2,670 m ² (0.7 ac) of undisturbed intertidal habitat and 890 m ² (0.2 ac) of armor rock (previously disturbed) intertidal area would be affected. <u>Subtidal Habitat:</u> Approx. 2,670 m ² (0.7 ac) of subtidal habitat would be affected. <u>Essential Fish Habitat:</u> Approx. 9,650 m ² (2.4 ac) of EFH would be affected. <u>Anadromous Streams:</u> Two anadromous streams would be crossed.
Natural Resource Impacts from Operation	Maintenance and long-term use of the roadway on Pennock and Gravina islands would adversely affect wetlands and intertidal areas as a result of runoff. The roadway also would affect use of the wetlands as habitat for land mammals on Pennock and Gravina islands. Shading by a bridge would negatively affect eelgrass beds and intertidal areas. Bridge piers may affect juvenile fish movement in nearshore areas.
Section 4(f) Properties	<u>Archaeological Resources:</u> The alignment could potentially cross burial grounds on Pennock Island that may be considered eligible for the National Register of Historic Places. <u>Historical Resources:</u> The alignment could affect the Headquarters Building of the 16 th Lighthouse District (KET-279) and the New England Fish Company cannery district (KET-492), both located on Revillagigedo Island. <u>Public Park/Recreation Areas/Refuges:</u> No effect.
Impacts to Land Use/Community Facilities	<u>Existing Development:</u> No effect. <u>Community Facilities:</u> The alignment is adjacent to the cemetery.
Aesthetics	The bridges would introduce new, highly visible structures in areas currently dominated by smaller scale, man-made structures and natural features. The bridges would become dominant features in the landscape.
Subsistence	This option would potentially disturb areas on Pennock Island that are used for subsistence and make these areas more accessible to the general population. This option would result in loss of subsistence resources.



Transportation Factors	
Vehicular Traffic Impacts During Construction and Operation	There is a potential for construction delays to traffic on Tongass Highway near the Coast Guard Base. Average Daily Traffic (1998) on Tongass Highway in the vicinity of the crossing is 4,602 vehicles. This alternative would affect parking, circulation, and utility requirements at the airport; however, the type and magnitude of the impacts cannot be characterized at this stage of the evaluation.
Marine Navigation During Construction	Most areas of the channels would be open during construction, except for the immediate area around the work barges. Ship traffic would be directed to the west channel while the high-level bridge is constructed in the east channel, thereby maintaining cruise ship passage throughout the construction period. The existing airport ferry service would not be affected by construction activities.
Marine Navigation During Operation	Vessels would be limited to 229 m (750 ft) horizontal and 64 m (210 ft) vertical clearances in the east channel, and 160 m (525 ft) horizontal and 37 m (120 ft) vertical clearances in the west channel. The airport ferry would be eliminated, which would have a positive effect on navigation in Tongass Narrows by reducing cross-channel ship traffic; however, the ferry would no longer be available as a possible search and rescue vessel.
Aviation Impacts During Construction	Floatplane operations would be affected by large cranes and other equipment in the east channel.
Aviation Impacts During Operation	The east channel is heavily used for floatplane operations. The height of the east channel bridge with the cable stayed structures [approx. 212 m (695 ft)] would adversely affect floatplane operations in the east channel. Floatplane operations in the less-frequently-used west channel would be adversely affected by the 46-m (150-ft) bridge. Neither bridge would penetrate aeronautical surfaces or affect current or known future approaches associated with Ketchikan International Airport.



OPTION F2: TUNNEL UNDER EAST CHANNEL – PENNOCK ISLAND



Option F2 includes a tunnel and a low-level bridge. The alignment for this option starts at Tongass Avenue just south of the U.S. Coast Guard Base, and then turns westward and crosses under the east channel of Tongass Narrows to Pennock Island. This option would cross Pennock Island at grade and then use a low-level bridge to extend over the west channel of Tongass Narrows. The low-level bridge would provide 160-m (525-ft) horizontal and 37-m (120-ft) vertical navigational clearances. The tunnel would be about 2.9 km (1.8 mi) long and would include a pedestrian walkway. Special monitoring and safety features would be designed into the tunnel.

Cost Factors

Total Project Costs	\$553 million
Annual Operation and Maintenance Costs	\$3.0 million
50-yr Lifecycle Costs	\$578 million

Purpose and Need Factors

Reliability of Access	<u>Hours of Operation Per Day:</u> 24 (No wait time is anticipated.) <u>Schedule Frequency:</u> Unlimited <u>Closure/Downtime:</u> Extreme high winds <u>Restrictions to Access:</u> Vehicles transporting hazardous materials and oversized/overweight vehicles would be prohibited from traveling through the tunnel.			
Efficiency and Convenience of Access to Borough and Other Lands on Gravina Island	<u>Travel Times (minutes)</u>	<u>Vehicles</u>	<u>Pedestrians</u>	<u>Bicycles</u>
	CBD – Private Land:	7	75	23
	CBD – Borough Land:	8	93	28
	Carlanna Creek – Private Land:	15	130	40
	Carlanna Creek – Borough Land:	16	148	45
	Ward Cove – Private Land:	21	220	67
	Ward Cove – Borough Land:	22	238	72



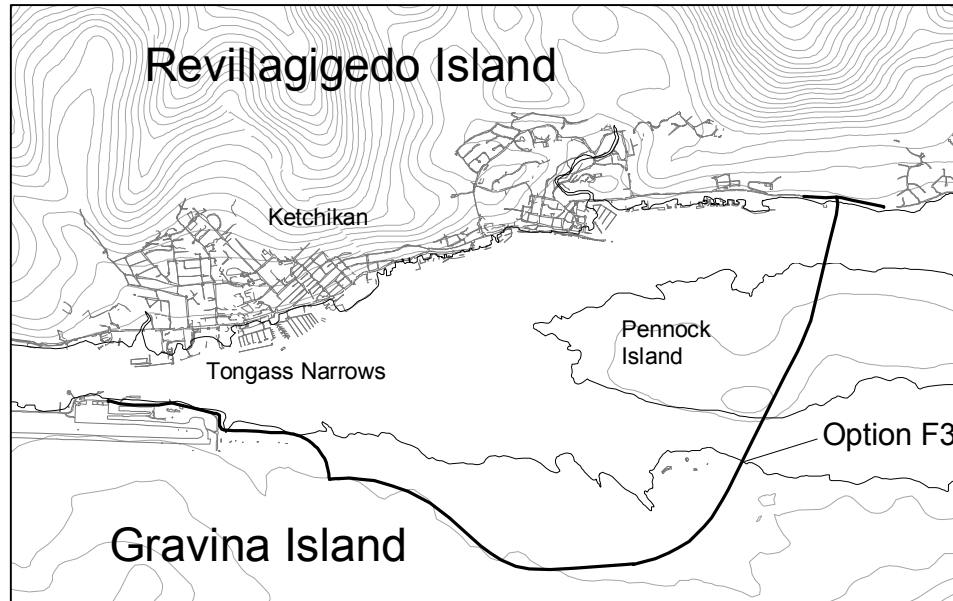
Convenience	<u>Distance from Various Locations to the Takeoff Point on Revilla:</u> Downtown Saxman: 2.1 km (1.3 mi) Downtown Ketchikan: 1.8 km (1.1 mi) Carlanna Creek: 6.3 km (3.9 mi) Ward Cove: 13.5 km (8.4 mi) Point Higgins: 24.5 km (15.2 mi)
Convenience of Access to Ketchikan International Airport	<u>Vehicle Travel Times (minutes)</u> Saxman – Airport Terminal: 8 CBD – Airport Terminal: 14 Carlanna Creek – Airport Terminal: 22 Ward Cove – Airport Terminal: 28 Point Higgins – Airport Terminal: 37 <u>Emergency Vehicle Travel Times (minutes)</u> Hospital – Airport Terminal: 18 Fire Station – Airport Terminal: 14
Physical Environmental Factors	
Natural Resource Impacts from Construction	<u>Wetlands/Estuaries:</u> Approx. 189,420m ² (46.8 ac) of palustrine wetlands and 2,370 m ² (0.6 ac) of estuarine wetlands on Gravina Island would be affected [approx. 191,800 m ² (47.4 ac) total]. <u>Eelgrass beds:</u> Approx. 890 m ² (0.2 ac) of a sparse eelgrass bed would be affected. <u>Intertidal Habitat:</u> Approx. 1,860 m ² (0.5 ac) of undisturbed intertidal habitat and 890 m ² (0.2 ac) of a former dump site (previously disturbed) intertidal area would be affected. <u>Subtidal Habitat:</u> Approx. 31,440 m ² (7.8 ac) of subtidal habitat would be affected. <u>Essential Fish Habitat:</u> Approx. 37,820 m ² (9.4 ac) of EFH would be affected. <u>Anadromous Streams:</u> Two anadromous streams would be crossed.
Natural Resource Impacts from Operation	Maintenance and long-term use of the roadway on Pennock and Gravina islands would adversely affect wetlands and intertidal areas as a result of runoff. The roadway also would affect use of the wetlands as habitat for land mammals on Pennock and Gravina islands. Shading by a bridge would negatively affect eelgrass beds and intertidal areas. Bridge piers and tunnel embankment may affect juvenile fish movement in nearshore areas.
Section 4(f) Properties	<u>Archaeological Resources:</u> The alignment could potentially cross burial grounds on Pennock Island that may be considered eligible for the National Register of Historic Places. <u>Historical Resources:</u> The alignment could affect the Headquarters Building of the 16 th Lighthouse District (KET-279) and the New England Fish Company cannery district (KET-492), both located on Revillagigedo Island. <u>Public Park/Recreation Areas/Refuges:</u> No effect.
Impacts to Land Use/Community Facilities	<u>Existing Development:</u> No effect. <u>Community Facilities:</u> No effect.
Aesthetics	The bridge over the west channel would introduce a new, man-made structure in an area currently dominated by natural features. The bridge would become a dominant feature in landscape of the west channel, but would not be visible from many areas of downtown Ketchikan. The visual environment in the east channel would remain primarily unchanged.



Subsistence	This option would potentially disturb areas on Pennock Island that are used for subsistence and make these areas more accessible to the general population. This option would result in loss of subsistence resources.
Transportation Factors	
Vehicular Traffic Impacts During Construction and Operation	There is a potential for construction delays to traffic on Tongass Highway near the Coast Guard Base. Average Daily Traffic (1998) on Tongass Highway in the vicinity of the crossing is 4,602 vehicles. This alternative would affect parking, circulation, and utility requirements at the airport; however, the type and magnitude of the impacts cannot be characterized at this stage of the evaluation.
Marine Navigation During Construction	Most areas of the channels would be open during construction, except for the immediate area around the work barges. Ship traffic would be directed to the west channel while the tunnel is constructed in the east channel, thereby maintaining cruise ship passage throughout the construction period. The existing airport ferry service would not be affected by construction activities.
Marine Navigation During Operation	The west channel would not accommodate ships larger than <i>Columbia</i> class vessels. Cruise ship traffic in the east channel would continue unaffected. The airport ferry would be eliminated, which would have a positive effect on navigation in Tongass Narrows by reducing cross-channel ship traffic; however, the ferry would no longer be available as a possible search and rescue vessel.
Aviation Impacts During Construction	Floatplane operations would be affected by large cranes and other equipment in the east channel.
Aviation Impacts During Operation	Floatplane operations in the less-frequently-used west channel would be adversely affected by the 46-m (150-ft) bridge. The bridge would not penetrate aeronautical surfaces or affect current or known future approaches associated with Ketchikan International Airport.



OPTION F3: HIGH-LEVEL BRIDGE OVER WEST CHANNEL – PENNOCK ISLAND



Option F3 is a low-level/high-level bridge option that would start at Tongass Avenue south of the U.S. Coast Guard Base and cross the east channel of Tongass Narrows to Pennock Island. The east channel crossing would be a low-level bridge providing 18 m (60 ft) of vertical clearance. This option would cross Pennock Island at grade and then use a second, high-level bridge over the west channel providing 64 m (210 ft) of vertical clearance and 168 m (550 ft) of horizontal clearance. The east channel and west channel bridges would be 0.8 to 1.1 km (0.5 and 0.7 mi) long, respectively.

Cost Factors

Total Project Costs	\$182 million
Annual Operation and Maintenance Costs	\$120,000
50-yr Lifecycle Costs	\$175 million

Purpose and Need Factors

Reliability of Access	<u>Hours of Operation Per Day:</u> 24 (No wait time is anticipated.)			
	<u>Schedule Frequency:</u> Unlimited			
	<u>Closure/Downtime:</u> Extreme high winds			
	<u>Restrictions to Access:</u> All vehicles would be permitted on the bridges and airport access road.			
Efficiency and Convenience of Access to Borough and Other Lands on Gravina Island	<u>Travel Times (minutes)</u>	<u>Vehicles</u>	<u>Pedestrians</u>	<u>Bicycles</u>
	CBD – Private Land:	6	61	19
	CBD – Borough Land:	7	78	24
	Carlanna Creek – Private Land:	14	116	36
	Carlanna Creek – Borough Land:	15	133	41
	Ward Cove – Private Land:	20	206	63
	Ward Cove – Borough Land:	21	223	68



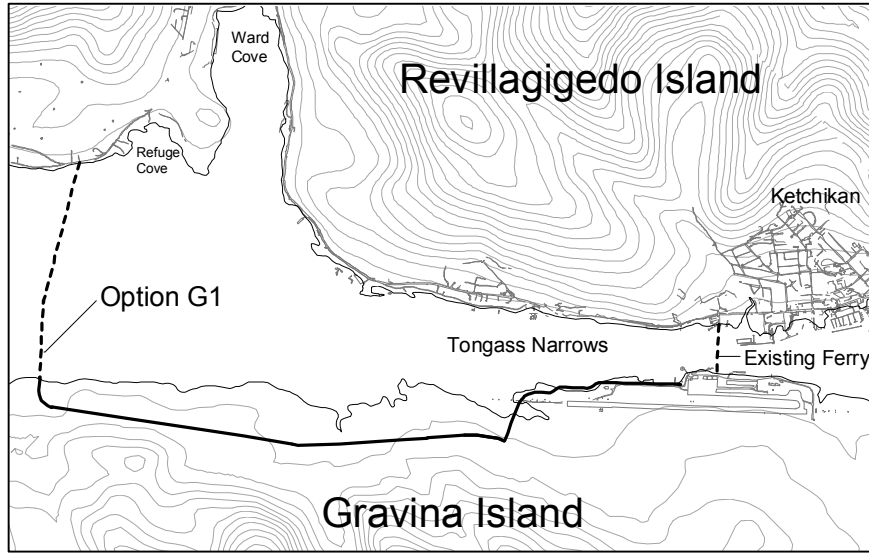
Convenience	<u>Distance from Various Locations to the Takeoff Point on Revilla:</u> Downtown Saxman: 2.7 km (1.7 mi) Downtown Ketchikan: 1.1 km (0.7 mi) Carlanna Creek: 5.6 km (3.5 mi) Ward Cove: 12.9 km (8.0 mi) Point Higgins: 23.8 km (14.8 mi)
Convenience of Access to Ketchikan International Airport	<u>Vehicle Travel Times (minutes)</u> Saxman – Airport Terminal: 14 CBD – Airport Terminal: 13 Carlanna Creek – Airport Terminal: 21 Ward Cove – Airport Terminal: 27 Point Higgins – Airport Terminal: 36 <u>Emergency Vehicle Travel Times (minutes)</u> Hospital – Airport Terminal: 16 Fire Station – Airport Terminal: 12
Physical Environmental Factors	
Natural Resource Impacts from Construction	<u>Wetlands/Estuaries Habitat:</u> Approx. 187,720 m ² (46.4 ac) of palustrine wetlands and 3,060 m ² (0.8 ac) of estuarine wetlands on Gravina Island would be affected [approx. 190,780 m ² (47.2 ac) total]. <u>Eelgrass Beds:</u> Eelgrass beds would be avoided. <u>Intertidal Habitat:</u> Approx. 2,670 m ² (0.7 ac) of undisturbed intertidal habitat and 890 m ² (0.2 ac) of armor rock (previously disturbed) intertidal area would be affected. <u>Subtidal Habitat:</u> Approx. 2,670 m ² (0.7 ac) of subtidal habitat would be affected. <u>Essential Fish Habitat:</u> Approx. 9,650 m ² (2.4 ac) of EFH would be affected. <u>Anadromous Streams:</u> Two anadromous streams would be crossed.
Natural Resource Impacts from Operation	Maintenance and long-term use of the roadway on Pennock and Gravina islands would adversely affect wetlands and intertidal areas as a result of runoff. The roadway also would affect use of the wetlands as habitat for land mammals on Pennock and Gravina islands. Shading by a bridge would negatively affect intertidal areas. Bridge piers may affect juvenile fish movement in nearshore areas.
Section 4(f) Properties	<u>Archaeological Resources:</u> The alignment could potentially cross burial grounds on Pennock Island that may be considered eligible for the National Register of Historic Places. <u>Historical Resources:</u> The alignment could affect the Headquarters Building of the 16 th Lighthouse District (KET-279) and the New England Fish Company cannery district (KET-492), both of which are on Revillagigedo Island. <u>Public Park/Recreation Areas/Refuges:</u> No effect.
Impacts to Land Use/Community Facilities	<u>Existing Development:</u> No effect. <u>Community Facilities:</u> The alignment is adjacent to the cemetery.
Aesthetics	The bridges would introduce new, highly visible structures in areas currently dominated by smaller scale, man-made structures and natural features. The bridges would become dominant features in the landscape. The low-level bridge would be consistent with the modest scale of other visible structures in the visual environment of the west channel. The high-level bridge would be located in a visual environment that is dominated by natural features, but the bridge would be screened from view from downtown Ketchikan.



Subsistence	This option would potentially disturb areas on Pennock Island that are used for subsistence and make these areas more accessible to the general population. This option would result in loss of subsistence resources.
Transportation Factors	
Vehicular Traffic Impacts During Construction and Operation	There is a potential for construction delays to traffic on Tongass Highway near the Coast Guard Base. Average Daily Traffic (1998) on Tongass Highway in the vicinity of the crossing is 4,602 vehicles. This alternative would affect parking, circulation, and utility requirements at the airport; however, the type and magnitude of the impacts cannot be characterized at this stage of the evaluation.
Marine Navigation During Construction	Most areas of the channels would be open during construction, except for the immediate area around the work barges. Ship traffic would be directed to the east channel while the high-level bridge is constructed in the west channel, thereby maintaining cruise ship passage throughout the construction period. The existing airport ferry service would not be affected by construction activities.
Marine Navigation During Operation	Cruise ships and other ships taller than 18 m (60 ft) would have to travel through the west channel. Currently, cruise ships rarely use the west channel. Cruise ship pilots expressed concern over tracking through the west channel due to shoaling at the north end of the channel. Vessels would be limited to 168 m (550 ft) horizontal and 64 m (210 ft) vertical clearances in the west channel, and 152 m (500 ft) horizontal and 18 m (60 ft) vertical clearances in the east channel. The airport ferry would be eliminated, which would have a positive effect on navigation in Tongass Narrows by reducing cross-channel ship traffic; however, the ferry would no longer be available as a possible search and rescue vessel.
Aviation Impacts During Construction	Floatplane operations would be affected by large cranes and other equipment in the east channel.
Aviation Impacts During Operation	The height of the east channel bridge [about 34 m (110 ft)] would have a minor impact on floatplane operations in the east channel. Floatplane operations in the less-frequently-used west channel would be adversely affected by the 76-m (250-ft) bridge. Neither bridge would penetrate aeronautical surfaces or affect current or known future approaches associated with Ketchikan International Airport.



OPTION G1: FERRY – REFUGE COVE



Option G1 is a ferry route that would complement the existing airport ferry. The Option G1 ferry route would transport cars and passengers between approximately mile 8.5 of Tongass Avenue near Refuge Cove and Gravina Island, approximately 4.5 km (2.8 mi) north of the airport. This option would require construction of a new ferry slip on each side of Tongass Narrows. The Option G1 ferry schedule would be similar to the existing airport ferry schedule with two ferries in operation during the summer.

Cost Factors

Total Project Costs	\$72 million
Annual Operation and Maintenance Costs	\$3.3 million
50-yr Lifecycle Costs	\$146 million

Purpose and Need Factors

Reliability of Access	<u>Hours of Operation Per Day:</u> 16 (On occasion, wait times for ferry may exceed 30 minutes because of peak ferry capacity.)			
	<u>Schedule Frequency:</u> 30 minutes (winter), 15 minutes (summer)			
	<u>Closure/Downtime:</u> 8 hours per day (at night); high winds/extreme weather, mechanical problems.			
	<u>Restrictions to Access:</u> None.			
Efficiency and Convenience of Access to Borough and Other Lands on Gravina Island	<u>Travel Times (minutes)</u>	<u>Vehicles</u>	<u>Pedestrians</u>	<u>Bicycles</u>
	CBD – Private Land:	47	202	83
	CBD – Borough Land:	47	204	84
	Carlanna Creek – Private Land:	39	147	66
	Carlanna Creek – Borough Land:	39	149	67
	Ward Cove – Private Land:	33	57	39
	Ward Cove – Borough Land:	33	59	40



Convenience	<u>Distance from Various Locations to the Takeoff Point on Revilla (new ferry/existing ferry):</u> Downtown Saxman: 17.7 km (11.0 mi)/8.4 km (5.2 mi) Downtown Ketchikan: 13.8 km (8.6 mi)/4.5 km (2.8 mi) Carlanna Creek: 9.3 km (5.8 mi)/0.0 km (0.0 mi) Ward Cove: 2.1 km (1.3 mi)/7.2 km (4.5 mi) Point Higgins: 8.9 km (5.5 mi)/18.2 km (11.3 mi)
Convenience of Access to Ketchikan International Airport	<u>Vehicle Travel Times (minutes: new ferry/existing ferry)</u> Saxman – Airport Terminal: 59/32 CBD – Airport Terminal: 54/27 Carlanna Cr. – Airport Terminal: 46/19 Ward Cove – Airport Terminal: 40/25 Point Higgins – Airport Terminal: 45/34 <u>Emergency Vehicle Travel Times (minutes: new ferry/existing ferry)</u> Hospital – Airport Terminal: 45/20 Fire Station – Airport Terminal: 41/20
Physical Environmental Factors	
Natural Resource Impacts from Construction	<u>Wetlands/Estuaries:</u> Approx. 201,400 m ² (49.8 ac) of palustrine wetlands and 5,810 m ² (1.4 ac) of estuarine wetlands on Gravina Island would be affected [approx. 207,210 m ² (51.2 ac) total]. <u>Eelgrass Beds:</u> Approx. 650 m ² (0.2 ac) of sparse eelgrass beds would be affected. <u>Intertidal Habitat:</u> Approx. 4,210 m ² (1.0 ac) of undisturbed intertidal habitat would be affected. <u>Subtidal Habitat:</u> Approx. 1,210 m ² (0.3 ac) of subtidal habitat would be affected. <u>Essential Fish Habitat:</u> Approx. 12,240 m ² (3.0 ac) of EFH would be affected. <u>Anadromous Streams:</u> Two anadromous streams would be crossed.
Natural Resource Impacts from Operation	Maintenance and long-term use of the roadway on Gravina Island would adversely affect wetlands and intertidal areas as a result of runoff. The roadway also would affect use of Gravina Island wetlands by land mammals. Ferry vessel emissions and maintenance activities would adversely affect intertidal areas. Terminal structures and shoreline alteration may affect juvenile fish movement in nearshore areas.
Section 4(f) Properties	<u>Archaeological Resources:</u> The ferry terminal would be near, but would not directly affect, a small shell midden (KET-303). The National Register eligibility of this site has yet to be determined. <u>Historical Resources:</u> The ferry terminal would be near, but would not directly affect, the Port Gravina site (KET-027). The National Register eligibility of this site has yet to be determined. <u>Public Park/Recreation Areas/Refuges:</u> The ferry terminal would be constructed on lands included in Refuge Cove State Park, a Section 4(f) property, on Revillagigedo Island. No other Section 4(f) properties would be affected.
Impacts to Land Use/Community Facilities	<u>Existing Development:</u> Park land and habitat at Refuge Cove would be altered by the ferry terminal and associated activity. <u>Community Facilities:</u> Refuge Cove State Park would be affected by the ferry terminal and associated activity.
Aesthetics	The ferry terminal on Gravina Island would be surrounded by natural features and would be a new visual element in the landscape.



Subsistence	Research and outreach to date have not identified impacts to subsistence uses.
Transportation Factors	
Vehicular Traffic Impacts During Construction and Operation	There is a potential for construction delays to traffic on Tongass Highway near Refuge Cove. Average Daily Traffic (1998) on Tongass Highway in the vicinity of the crossing is 5,672 vehicles. This alternative would affect parking, circulation, and utility requirements at the airport; however, the type and magnitude of the impacts cannot be characterized at this stage of the evaluation.
Marine Navigation During Construction	No effect.
Marine Navigation During Operation	Additional cross-channel ferry traffic would increase the potential for conflict with ships traveling through Tongass Narrows. The additional ferry route would enhance the availability of search and rescue opportunities.
Aviation Impacts During Construction	No effect.
Aviation Impacts During Operation	No effect.



OPTION G2: FERRY – PENNINSULA POINT



Option G2 is a ferry route that would complement the existing airport ferry. The Option G2 ferry route would transport cars and passengers between Peninsula Point and Gravina Island, south of Lewis Reef and south of the Seeley Corporation timber processing plant. This option would require construction of a new ferry slip on each side of Tongass Narrows. The Option G2 ferry schedule would be similar to the existing airport ferry schedule with two ferries in operation during the summer.

Cost Factors

Total Project Costs	\$60 million
Annual Operation and Maintenance Costs	\$3.3 million
50-yr Lifecycle Costs	\$134 million

Purpose and Need Factors

Reliability of Access	<u>Hours of Operation Per Day:</u> 16 (On occasion, wait times for ferry may exceed 30 minutes because of peak ferry capacity.) <u>Schedule Frequency:</u> 30 minutes (winter), 15 minutes (summer) <u>Closure/Downtime:</u> 8 hours per day (night); high winds/extreme weather mechanical problems. <u>Restrictions to Access:</u> None.			
Efficiency and Convenience of Access to Borough and Other Lands on Gravina Island	<u>Travel Times (minutes)</u>	<u>Vehicles</u>	<u>Pedestrians</u>	<u>Bicycles</u>
	CBD – Private Land:	35	123	54
	CBD – Borough Land:	36	132	57
	Carlanna Creek – Private Land:	27	68	37
	Carlanna Creek – Borough Land:	28	77	40
	Ward Cove – Private Land:	27	70	38
	Ward Cove – Borough Land:	28	79	41

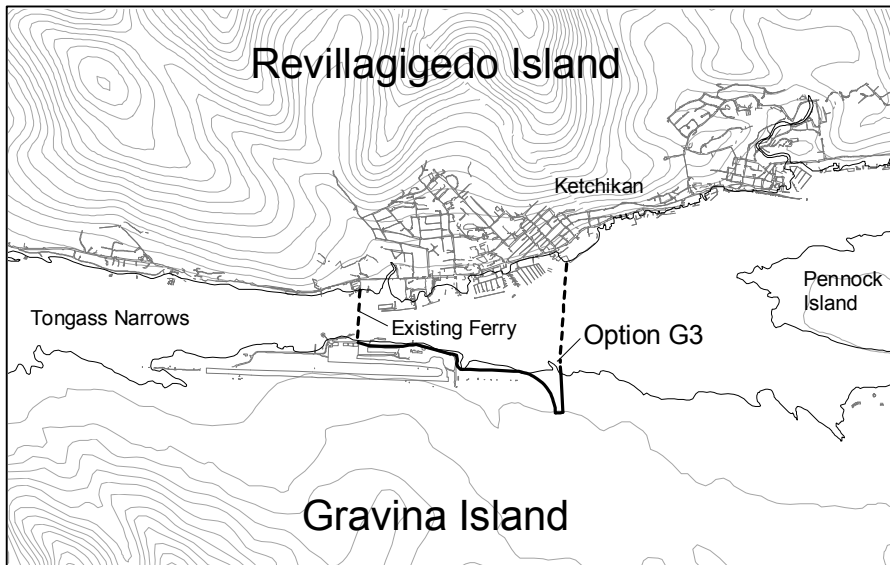
Convenience	<u>Distance from Various Locations to the Takeoff Point on Revilla (new ferry/existing ferry):</u> Downtown Saxman: 11.9 km (7.4 mi)/8.4 km (5.2 mi) Downtown Ketchikan: 8.0 km (5.0 mi)/4.5 km (2.8 mi) Carlanna Creek: 3.5 km (2.2 mi)/0.0 km (0.0 mi) Ward Cove: 3.7 km (2.3 mi)/7.2 km (4.5 mi) Point Higgins: 14.6 km (9.1 mi)/18.2 km (11.3 mi)
Convenience of Access to Ketchikan International Airport	<u>Vehicle Travel Times (minutes: new ferry/existing ferry)</u> Saxman – Airport Terminal: 45/32 CBD – Airport Terminal: 40/27 Carlanna Cr. – Airport Terminal: 32/19 Ward Cove – Airport Terminal: 32/25 Point Higgins – Airport Terminal: 41/34 <u>Emergency Vehicle Travel Times (minutes: new ferry/existing ferry)</u> Hospital – Airport Terminal: 33/20 Fire Station – Airport Terminal: 29/20
Physical Environmental Factors	
Natural Resource Impacts from Construction	<u>Wetlands/Estuaries:</u> Approx. 87,207 m ² (27.5 ac) of palustrine wetlands and 679 m ² (0.2 ac) of estuarine wetlands on Gravina Island would be affected [approx. 87,886 m ² (27.7 ac) total]. <u>Eelgrass Beds:</u> It is not known whether this option would affect eelgrass beds because the marine habitat in this area has not been investigated. <u>Intertidal Habitat:</u> The marine habitat in this area has not been investigated. Approx. 2,100 m ² (0.5 ac) of undisturbed intertidal habitat and 2,100 m ² (0.5 ac) of armor rock (previously disturbed) intertidal area may be affected. <u>Subtidal Habitat:</u> Approx. 1,210 m ² (0.3 ac) of subtidal habitat may be affected. <u>Essential Fish Habitat:</u> Approx. 6,466 m ² (1.63 ac) of EFH would be affected. <u>Anadromous Streams:</u> Two anadromous streams would be crossed.
Natural Resource Impacts from Operation	Activities associated with a ferry terminal on Lewis Point would affect an active bald eagle nest site on Lewis Point and a unique sedge meadow on the south side of Lewis Reef that provides important forage habitat for bears and deer. The roadway also would affect use of the wetlands as habitat for land mammals on Gravina Island. Maintenance and long-term use of the roadway on Gravina Island would adversely affect wetlands and intertidal areas as a result of runoff. Ferry vessel emissions and maintenance activities near Lewis Reef would adversely affect the productivity of that ecosystem. Terminal structures and shoreline alteration may affect juvenile fish movement in nearshore areas.
Section 4(f) Properties	<u>Archaeological Resources:</u> No known effect. <u>Historical Resources:</u> The alignment would be near, but would not directly affect, the Port Gravina site (KET-027). The National Register eligibility of this site has yet to be determined. <u>Public Park/Recreation Areas/Refuges:</u> No effect.
Impacts to Land Use/Community Facilities	<u>Existing Development:</u> The floatplane base on Peninsula Point may be affected. <u>Community Facilities:</u> No effect.
Aesthetics	The new ferry terminal on Revillagigedo Island would not affect the visual environment because the scale of the terminal would be consistent with existing shoreline structures. The ferry terminal on Gravina Island would be surrounded by natural features and would be a new visual element in the landscape.
Subsistence	Research and outreach to date have not identified impacts to subsistence uses.



Transportation Factors	
Vehicular Traffic Impacts During Construction and Operation	No effect. Average Daily Traffic (1998) on Tongass Avenue in the vicinity of the crossing is 7,720 vehicles. This alternative would affect parking, circulation, and utility requirements at the airport; however, the type and magnitude of the impacts cannot be characterized at this stage of the evaluation.
Marine Navigation During Construction	No effect.
Marine Navigation During Operation	Additional cross-channel ferry traffic would increase the potential for conflict with ships traveling through Tongass Narrows. The additional ferry route would enhance the availability of search and rescue opportunities.
Aviation Impacts During Construction	No effect.
Aviation Impacts During Operation	No effect.



OPTION G3: FERRY – DOWNTOWN



Option G3 is a ferry route that would complement the existing airport ferry. The Option G3 ferry route would transport cars and passengers between a location in downtown Ketchikan to Gravina Island, south of the airport. This option would require construction of a new ferry slip on each side of Tongass Narrows. The Option G3 ferry schedule would be similar to the existing airport ferry schedule with two ferries in operation during the summer.

Cost Factors

Total Project Costs	\$47 million
Annual Operation and Maintenance Costs	\$3.3 million
50-yr Lifecycle Costs	\$122 million

Purpose and Need Factors

Reliability of Access	<u>Hours of Operation Per Day:</u> 16 (On occasion, wait times for ferry may exceed 30 minutes.) <u>Schedule Frequency:</u> 30 minutes (winter), 15 minutes (summer) <u>Closure/Downtime:</u> 8 hours per day (night); high winds/extreme weather, mechanical problems. <u>Restrictions to Access:</u> None.																														
Efficiency and Convenience of Access to Borough and Other Lands on Gravina Island	<u>Travel Times (minutes)</u> <table> <tr> <th></th><th><u>Vehicles</u></th><th><u>Pedestrians</u></th><th><u>Bicycles</u></th></tr> <tr> <td>CBD – Private Land:</td><td>24</td><td>34</td><td>26</td></tr> <tr> <td>CBD – Borough Land:</td><td>26</td><td>59</td><td>33</td></tr> <tr> <td>Carlanna Creek – Private Land:</td><td>30</td><td>78</td><td>39</td></tr> <tr> <td>Carlanna Creek – Borough Land:</td><td>32</td><td>103</td><td>46</td></tr> <tr> <td>Ward Cove – Private Land:</td><td>36</td><td>168</td><td>66</td></tr> <tr> <td>Ward Cove – Borough Land:</td><td>38</td><td>193</td><td>73</td></tr> </table>				<u>Vehicles</u>	<u>Pedestrians</u>	<u>Bicycles</u>	CBD – Private Land:	24	34	26	CBD – Borough Land:	26	59	33	Carlanna Creek – Private Land:	30	78	39	Carlanna Creek – Borough Land:	32	103	46	Ward Cove – Private Land:	36	168	66	Ward Cove – Borough Land:	38	193	73
	<u>Vehicles</u>	<u>Pedestrians</u>	<u>Bicycles</u>																												
CBD – Private Land:	24	34	26																												
CBD – Borough Land:	26	59	33																												
Carlanna Creek – Private Land:	30	78	39																												
Carlanna Creek – Borough Land:	32	103	46																												
Ward Cove – Private Land:	36	168	66																												
Ward Cove – Borough Land:	38	193	73																												



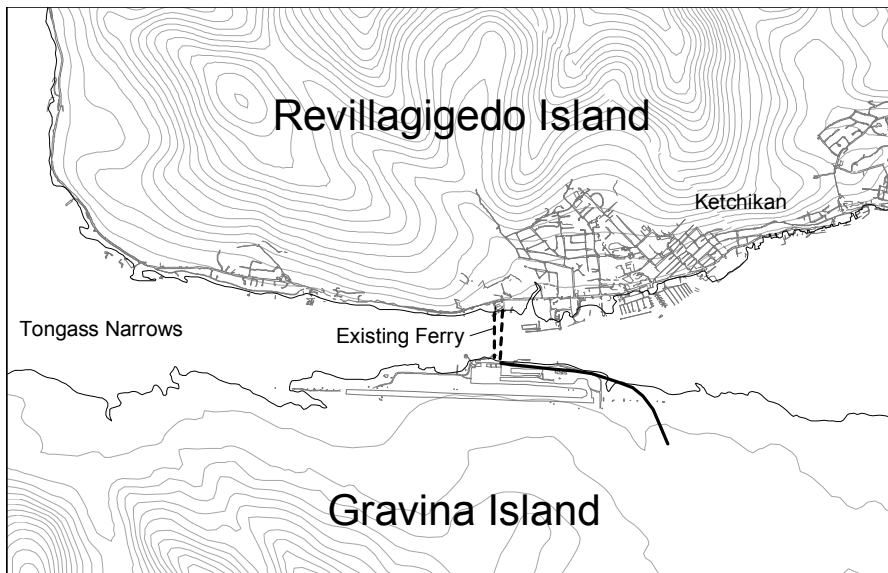
Convenience	<u>Distance from Various Locations to the Takeoff Point on Revilla (new ferry/existing ferry):</u> Downtown Saxman: 4.3 km (2.7 mi)/8.4 km (5.2 mi) Downtown Ketchikan: 0.5 km (0.3 mi)/4.5 km (2.8 mi) Carlanna Creek: 4.0 km (2.5 mi)/0.0 km (0.0 mi) Ward Cove: 11.3 km (7.0 mi)/7.2 km (4.5 mi) Point Higgins: 22.2 km (13.8 mi)/18.2 km (11.3 mi)
Convenience of Access to Ketchikan International Airport	<u>Vehicle Travel Times (minutes: new ferry/existing ferry)</u> Saxman – Airport Terminal: 32/32 CBD – Airport Terminal: 27/27 Carlanna Cr. – Airport Terminal: 33/19 Ward Cove – Airport Terminal: 39/25 Point Higgins – Airport Terminal: 48/34 <u>Emergency Vehicle Travel Times (minutes: new ferry/existing ferry)</u> Hospital – Airport Terminal: 29/20 Fire Station – Airport Terminal: 25/20
Physical Environmental Factors	
Natural Resource Impacts from Construction	<u>Wetlands/Estuaries:</u> Approx. 44,960 m ² (11.1 ac) of palustrine wetlands and 4,660 m ² (1.2 ac) of estuarine wetlands on Gravina Island would be affected [approx. 49,620 m ² (12.3 ac) total]. <u>Eelgrass Beds:</u> Eelgrass beds would be avoided. <u>Intertidal Habitat:</u> Approx. 2,100 m ² (0.5 ac) of undisturbed intertidal habitat and 2,100 m ² (0.5 ac) of armor rock (previously disturbed) intertidal area would be affected. <u>Subtidal Habitat:</u> Approx. 1,210 m ² (0.3 ac) of subtidal habitat would be affected. <u>Essential Fish Habitat:</u> Approx. 10,270 m ² (2.6 ac) of EFH would be affected. <u>Anadromous Streams:</u> One anadromous stream would be crossed.
Natural Resource Impacts from Operation	Maintenance and long-term use of the roadway on Gravina Island could adversely affect wetlands and intertidal areas as a result of runoff. The roadway also would affect use of the wetlands as habitat for land mammals on Gravina Island. Ferry vessel emissions and maintenance activities in intertidal areas would adversely affect the productivity of that ecosystem. Terminal structures and shoreline alteration may affect juvenile fish movement in nearshore areas.
Section 4(f) Properties	<u>Archaeological Resources:</u> No effect. <u>Historical Resources:</u> No effect. <u>Public Park/Recreation Areas/Refuges:</u> No effect.
Impacts to Land Use/Community Facilities	<u>Existing Development:</u> Right-of-way would be required in the commercial area of downtown Ketchikan. <u>Community Facilities:</u> No effect.
Aesthetics	The ferry terminal in downtown Ketchikan would affect the visual environment, depending on its compatibility with surrounding structures. The ferry terminal on Gravina Island would be surrounded by natural features and would add a new visual element in the landscape.
Subsistence	Research and outreach to date have not identified impacts to subsistence uses.



Transportation Factors	
Vehicular Traffic Impacts During Construction and Operation	No effect. Average Daily Traffic (1998) on Tongass Avenue in the vicinity of the crossing is 20,245 vehicles. This alternative would affect parking, circulation, and utility requirements at the airport; however, the type and magnitude of the impacts cannot be characterized at this stage of the evaluation.
Marine Navigation During Construction	No effect.
Marine Navigation During Operation	Additional cross-channel ferry traffic would increase the potential for conflict with ships traveling through Tongass Narrows. The additional ferry route would enhance the availability of search and rescue opportunities.
Aviation Impacts During Construction	No effect.
Aviation Impacts During Operation	Option G3 would have no effect on airport operations. The new ferry route in the harbor area where floatplanes are very active would adversely affect floatplane operations.



OPTION G4: FERRY – EXPANDED EXISTING



Option G4 involves adding ferry service to the existing ferry route. This would require construction of a new berth at each of the existing ferry terminals on either side of Tongass Narrows. The Option G4 ferry schedule would be established to provide more frequent sailings than the existing ferries provide. The road would terminate at the nearest boundary between the Airport Reserve and the Airport Development Zone and would include an exit to the airport terminal.

Cost Factors				
Total Project Costs	\$43 million			
Annual Operation and Maintenance Costs	\$3.3 million			
50-yr Lifecycle Costs	\$118 million			
Purpose and Need Factors				
Reliability of Access	<u>Hours of Operation Per Day:</u> 16 (On occasion, wait times for ferry may exceed 15 minutes if only one ferry is operating.)			
	<u>Schedule Frequency:</u> 15 minutes (winter), 7½ minutes (summer)			
	<u>Closure/Downtime:</u> 8 hours per day (night); high winds/extreme weather, mechanical problems.			
	<u>Restrictions to Access:</u> None.			
Efficiency and Convenience of Access to Borough and Other Lands on Gravina Island	<u>Travel Times (minutes)</u>	<u>Vehicles</u>	<u>Pedestrians</u>	<u>Bicycles</u>
	CBD – Private Land:	27	101	42
	CBD – Borough Land:	29	126	49
	Carlanna Creek – Private Land:	19	46	25
	Carlanna Creek – Borough Land:	21	71	32
	Ward Cove – Private Land:	25	136	52
	Ward Cove – Borough Land:	27	161	59

Convenience	<u>Distance from Various Locations to the Takeoff Point on Revilla:</u> Downtown Saxman: 8.4 km (5.2 mi) Downtown Ketchikan: 4.5 km (2.8 mi) Carlanna Creek: 0.0 km (0.0 mi) Ward Cove: 7.2 km (4.5 mi) Point Higgins: 18.2 km (11.3 mi)
Convenience of Access to Ketchikan International Airport	<u>Vehicle Travel Times (minutes)</u> Saxman – Airport Terminal: 29 CBD – Airport Terminal: 24 Carlanna Cr. – Airport Terminal: 16 Ward Cove – Airport Terminal: 22 Point Higgins – Airport Terminal: 31 <u>Emergency Vehicle Travel Times (minutes)</u> Hospital – Airport Terminal: 17 Fire Station – Airport Terminal: 17
Physical Environmental Factors	
Natural Resource Impacts from Construction	<u>Wetlands/Estuarine:</u> Approx. 13,740 m ² (3.4 ac) of palustrine wetlands on Gravina Island would be affected. <u>Eelgrass Beds:</u> Approx. 650 m ² (0.2 ac) eelgrass beds would be affected. <u>Intertidal Habitat:</u> Approx. 4,210 m ² (1.0 ac) of armor rock (previously disturbed) intertidal area would be affected. <u>Subtidal Habitat:</u> Approx. 1,210 m ² (0.3 ac) of subtidal habitat would be affected. <u>Essential Fish Habitat:</u> Approx. 6,070 m ² (1.5 ac) of EFH would be affected. <u>Anadromous Streams:</u> No anadromous streams would be crossed.
Natural Resource Impacts from Operation	Ferry vessel emissions and maintenance activities could adversely affect intertidal areas. Terminal structures and shoreline alteration may affect juvenile fish movement in nearshore areas.
Section 4(f) Properties	<u>Archaeological Resources:</u> No effect. <u>Historical Resources:</u> No effect. <u>Public Park/Recreation Areas/Refuges:</u> No effect.
Impacts to Land Use/Community Facilities	<u>Existing Development:</u> Area is commercial/industrial in nature. <u>Community Facilities:</u> No effect.
Aesthetics	The new ferry terminals and ferry service would be of the same scale as existing shoreline structures and vessels traversing Tongass Narrows. The location of the new facilities adjacent to the existing ferry facilities minimizes the effect on the visual environment.
Subsistence	Research and outreach to date have not identified impacts to subsistence uses.



Transportation Factors	
Vehicular Traffic Impacts During Construction and Operation and Operation	No effect. Average Daily Traffic (1998) on Tongass Avenue in the vicinity of the crossing is 9,72 vehicles. This alternative would affect parking, circulation, and utility requirements at the airport; however, the type and magnitude of the impacts cannot be characterized at this stage of the evaluation.
Marine Navigation During Construction	No effect.
Marine Navigation During Operation	Additional cross-channel ferry traffic would increase the potential for conflict with ships traveling through Tongass Narrows. The additional ferry route would enhance the availability of search and rescue opportunities.
Aviation Impacts During Construction	No effect.
Aviation Impacts During Operation	Option G4 would have no effect on airport operations. The additional ferry traffic in Tongass Narrows would adversely affect floatplane operations.



4.0 Identification of Reasonable Alternatives

4.1 Introduction

The information presented for each of the Gravina Access Project alternatives in the Alternative Fact Sheets establishes a platform for a determination of those alternatives that are considered reasonable and those that are not. The National Environmental Policy Act (NEPA) considers reasonable those alternatives that are practical or feasible from a technical and economic standpoint and using common sense.⁴ Reasonable in this context means those alternatives that, when considered relative to each of the factors described earlier, could reasonably be implemented and therefore should be evaluated further in the NEPA document being prepared for this project. Reasonable is not, however, intended to imply that any one alternative is more preferable than any other. That determination will be decided later during the analysis contained in the NEPA document.

The evaluation of the alternatives with respect to the screening factors is used to identify those alternatives that are reasonable and those that do not warrant continued evaluation. Those alternatives that are found to be reasonable as a result of the screening process, as well as the no action alternative, will be the subject of more specific and detailed studies in the NEPA document. As the results of those studies are prepared, the public, agencies, and the project team will be able to make an informed decision about which alternative to recommend as most appropriate (the “preferred alternative”) for the Gravina Access Project.

In this section, we analyze each of the alternatives with respect to: 1) its consistency with the factors derived from the purpose and need statement; 2) its reasonableness in terms of potential environmental effects; 3) its reasonableness in terms of transportation-related effects; and 4) its projected costs and whether they fall within a realistic range. The basis of our analysis is the information contained in the Alternative Fact Sheets (pages 6 through 61).

4.1.1 Consistency with the Purpose and Need Statement

An alternative’s consistency with the purpose and need statement is an important consideration in evaluating the reasonableness of an alternative. In determining consistency with the purpose and need for the project, the alternative should satisfy the purpose of the project (i.e. to improve surface transportation between Revillagigedo Island and Gravina Island) and fulfill the needs identified in support of the project purpose (see Section 2.2). In this analysis, each alternative is evaluated in terms of its ability to improve the transportation connection between the islands as compared to the existing condition. One measure used in this analysis is the travel time from various locations on Revillagigedo Island to private and Ketchikan Gateway Borough land on Gravina Island and to Ketchikan International Airport.⁵ The tables in Appendix D show the travel times between these various origins and destinations for each of the 18 build alternative concepts and, where appropriate, the no action alternative.

⁴ Council on Environmental Quality: 40 Most Asked Questions Concerning CEQ’s NEPA Regulations; 46 Fed. Reg. 18026, as amended, 51 Fed. Reg. 15618.

⁵ Under existing conditions and the no action alternative, access to Borough and private lands by vehicle is not possible; therefore all build alternative concepts provide some measure of improvement for access to these lands.



4.1.2 Consideration of Cost Factors

The costs associated with each of the alternatives relative to the currently available and potential future funding are also important considerations in determining which alternatives are reasonable. To date, the federal government has allocated \$20.4 million to the Gravina Access Project as a high priority project of the Transportation Equity Act for the 21st Century (TEA-21). High priority project funding requires that the state, local government, or a private source provide a matching amount of 20 percent (with the federal government providing 80 percent). Funding for the entire project development amount over and above \$20.4 million has not been identified. The Alaska Department of Transportation and Public Facilities (DOT&PF) has committed to match the initial TEA-21 allocation through the design phase of the project. Beyond final project design, however, funding for the match of construction phase activities has not been identified. While other funding sources might be available to augment these funds, our analysis assumes that no other funding sources would contribute substantially to the project beyond federal, state, and local government sources.

The DOT&PF determined that, based on available state and federal funds, the practical limit of funding for the project over a 50-year life cycle is \$175 million. This is based on the Department's position that an alternative substantially beyond \$175 million is not reasonable and thus should not be carried forward for further study. It should be noted that this is not a DOT&PF commitment of funds for the project. The following table shows how the costs associated with each of the alternatives compares to the state-determined \$175 million cap on total life cycle costs.

Option	Total Life Cycle Cost (50-year)
NB	(\$28,370,260)
D1	(\$86,175,495)
G4	(\$117,777,541)
G3	(\$122,067,877)
C3	(\$139,999,378)
G2	(\$140,520,001)
G1	(\$145,817,407)
C4	(\$146,508,879)
F3	(\$174,640,875)
\$175,000,000	
C2	(\$197,089,396)
F1	(\$197,672,338)
F1 (CABLE)	(\$204,088,194)
C1	(\$230,695,389)
D2	(\$241,158,977)
A	(\$255,990,141)
E	(\$300,753,060)
B	(\$364,865,353)
E2	(\$384,779,477)
F2	(\$578,236,098)



4.1.3 Consideration of Environmental and Transportation Factors

All of the alternatives have been characterized in general terms with respect to environmental and transportation effects using the facts presented in the Alternatives Facts Sheets. The application of these factors is based on the best information currently available using the preliminary engineering and environmental data developed for the Gravina Access Project. It appears that the evaluation of an alternative for each environmental and transportation factor does not, in and of itself, establish a clear determination of reasonableness. However, when combined with the other factors presented, they help distinguish which alternatives should be carried forward into the NEPA process.

The evaluation of reasonable alternatives in the NEPA document will include a detailed investigation of the social, economic, and environmental resources potentially affected by the project. In addition to the factors employed in the screening process, the NEPA document will investigate in detail all of the standard NEPA topical areas required to provide a complete analysis and disclosure of project impacts.

4.2 Analysis of Alternatives

4.2.1 No Action Alternative

The no action alternative, the existing airport ferry, would maintain the status quo and would not result in improved transportation between Revillagigedo Island and Gravina Island. The costs associated with no action include annual operation and maintenance costs, which are equivalent to the existing operation and maintenance costs of the airport ferry and related facilities, and costs for periodic maintenance to those facilities (e.g., ferry replacement, repaving, and terminal maintenance) during a 50-year life cycle. This alternative does not improve access between the islands and does not meet the purpose and need of the project. For comparative purposes, however, and in accordance with NEPA, the no action alternative will be evaluated in the NEPA document.

4.2.2 Option A: High-level Bridge – Refuge Cove Area

This alternative would improve access between Revillagigedo and Gravina islands by providing access for vehicles to Borough and private lands on Gravina Island. The travel time for vehicles enroute to the airport from Carlanna Creek and points south (representing approximately 76 percent of the population) would be approximately 2 minutes shorter than the existing condition. The road and bridge connection would be operational 24 hours per day and would provide more reliable and convenient access for vehicular traffic, including emergency vehicles, between the two islands.

The primary environmental and transportation issues associated with this alternative include potential impacts to Refuge Cove State Park (a Section 4(f) property), impacts to natural resources along the roadway corridor, and the effects of the bridge on shipping and on floatplane and helicopter operations. Effects on a Section 4(f) property could not be avoided under Option A without taking residential properties that occupy the land to the north and south of Refuge Cove State Park. Houses are dispersed along the shoreline surrounding Refuge Cove and boat houses occur within Mud Bay, which is located immediately north of Refuge Cove. In addition to the effects on a Section 4(f) property, Option A would traverse approximately 187,000 m²



(46 acres) of wetlands. Two anadromous streams would be crossed and would be affected by instream construction and runoff during long-term use of the roadway. The effects of Option A on transportation include the effects that the 76-meter (250-foot) high bridge structure would have on floatplane maneuvers in that area. Option A passes close to residential properties in Refuge Cove and would adversely affect these properties.

The 50-year life cycle costs associated with Option A would be \$256 million, which exceeds the practical limit of project funding by \$81 million. While the annual operation and maintenance costs would be low (\$100,000) compared to the operation and maintenance costs of the existing airport ferry (\$1.1 million), the overall project costs of Option A are not reasonable. Option A also has potential Section 4(f) impacts and adverse impacts to residential property. For these reasons Option A is not considered a reasonable alternative and is not recommended for additional analysis in the NEPA document.

4.2.3 Option B: High-level Bridge – Peninsula Point Area

This alternative would improve access between Revillagigedo and Gravina islands by providing access for vehicles to Borough and private lands on Gravina Island. Vehicle travel time from all locations on Revillagigedo Island to Ketchikan International Airport would improve by 8 to 16 minutes. The road and bridge connection would be operational 24 hours per day and would provide more reliable access for travel between the two islands.

The primary environmental and transportation issues associated with this alternative include impacts to natural resources along the roadway corridor and the effects of the bridge on shipping and floatplane operations in Tongass Narrows. Option B would have adverse effects on natural resources under its 2.3-km (1.4-mile) bridge span and along the access road from the bridge to the airport terminal. Approximately 134,000 m² (33 acres) of wetlands would be affected. Two anadromous streams would be crossed and would be affected by instream construction and runoff during long-term use of the roadway. The effects of Option B on transportation include the effects that the 76-meter (250-foot) high bridge structure would have on floatplane and helicopter operations in that area.

The 50-year life cycle costs associated with Option B would be \$365 million, which exceeds the practical limit of project funding by \$190 million. While the annual operation and maintenance costs would be low (\$100,000) compared to the operation and maintenance costs of the existing airport ferry (\$1.1 million), the overall project costs of Option B would not be reasonable. Option B is not considered reasonable due to the estimated cost being substantially higher than the practical funding limit established by DOT&PF. It is not recommended for additional analysis in the NEPA document.

4.2.4 Option C1: High-level Bridge – Airport Area North

This alternative would improve access between Revillagigedo and Gravina islands by providing access for vehicles to Borough and private lands on Gravina Island. Vehicle travel time from all locations on Revillagigedo Island to Ketchikan International Airport would improve by 13 to 15 minutes. The road and bridge connection would be operational 24 hours per day and would provide more reliable access for travel between the two islands.



The primary environmental and transportation issues associated with this alternative include impacts to natural resources under the bridge structure and the effects of the bridge on shipping and floatplane operations in Tongass Narrows. The 2.7-km (1.7-mile) bridge span would shadow intertidal habitat and eelgrass beds, and bridge piers could affect juvenile fish movement in near-shore areas where the bridge parallels the shoreline of Gravina Island. The transportation issues associated with Option C1 include: the effects of construction equipment and activity in Tongass Narrows on marine navigation and floatplane and helicopter operations; the effects of the 76-meter (250-foot) bridge structure on floatplane maneuvers in Tongass Narrows and on aircraft operations at Ketchikan International Airport (the bridge would penetrate the horizontal and transitional surfaces requiring mitigation through appropriate marking and lighting); and the effects of aligning the bridge over the floatplane dock at the airport.

The 50-year life cycle costs associated with Option C1 would be \$231 million, which exceeds the practical limit of project funding by \$56 million. While the annual operation and maintenance costs would be low (\$100,000) compared to the operation and maintenance costs of the existing airport ferry (\$1.1 million), the overall project costs of Option C1 would not be reasonable. Option C1 is not considered reasonable because of the estimated high cost of the alternative and is not recommended for further study in the NEPA document.

4.2.5 Option C2: High-level Bridge – Airport Area South

This alternative would improve access between Revillagigedo and Gravina islands by providing access for vehicles to Borough and private lands on Gravina Island. Vehicle travel time from all locations on Revillagigedo Island to Ketchikan International Airport would improve by approximately 14 minutes. The road and bridge connection would be operational 24 hours per day and would provide more reliable access for travel between the two islands.

The primary environmental and transportation issues associated with this alternative include impacts to natural resources under the bridge structure and the effects of the bridge on shipping and floatplane operations in Tongass Narrows. The 2.4-km (1.5-mile) bridge span would shadow intertidal habitat and eelgrass beds, and bridge piers could affect juvenile fish movement in near-shore areas where the bridge parallels the shoreline of Gravina Island. The transportation issues associated with Option C2 include: the effects of construction equipment and activity in Tongass Narrows on marine navigation (including the existing airport ferry service) and floatplane and helicopter operations; the effects of the 76-meter (250-foot) bridge structure on floatplane maneuvers in Tongass Narrows and on aircraft operations at Ketchikan International Airport (the bridge would penetrate the horizontal and transitional surfaces requiring mitigation through appropriate marking and lighting); and the effects of aligning the bridge over the floatplane dock at the airport.

The 50-year life cycle costs associated with Option C2 would be \$197 million, which exceeds the practical limit of project funding by \$22 million. While the annual operation and maintenance costs would be low (\$100,000) compared to the operation and maintenance costs of the existing airport ferry (\$1.1 million), the overall project costs of Option C2 would not be reasonable. Option C2 is not considered reasonable because of the estimated high cost of the alternative and is not recommended for further study in the NEPA document.



4.2.6 Option C3: Modified High-level Bridge – Airport Area to Signal Road

This alternative would improve access between Revillagigedo and Gravina islands by providing access for vehicles to Borough and private lands on Gravina Island. Vehicle travel time from all locations on Revillagigedo Island to Ketchikan International Airport would improve over the existing condition by 11 to 15 minutes. The road and bridge connection would be operational 24 hours per day and would provide more reliable access for travel between the two islands.

The primary environmental and transportation issues associated with this alternative include impacts to natural resources under the bridge structure and the effects of the bridge on shipping and floatplane operations in Tongass Narrows. The 1.6-km (1.0-mile) bridge span would shadow intertidal habitat and eelgrass beds, and bridge piers could affect juvenile fish movement in near-shore areas where the bridge parallels the shoreline of Gravina Island. The transportation issues associated with Option C3 include: the effects of construction equipment and activity in Tongass Narrows on marine navigation (including the existing airport ferry service) and floatplane and helicopter operations; the effects of the 76-meter (250-foot) bridge structure on floatplane maneuvers in Tongass Narrows and on aircraft operations at Ketchikan International Airport (the bridge would penetrate the horizontal and transitional surfaces requiring mitigation through appropriate marking and lighting); and the effects of aligning the bridge over the floatplane dock at the airport. Marine navigation would be limited through the 168-meter (550-foot) horizontal span of the bridge and the U.S. Coast Guard may restrict vessel traffic to one way for large ships passing under the bridge.

The 50-year life cycle costs of \$140 million associated with Option C3 would be within the practical limit of project funding. Annual operation and maintenance costs of Option C3 would be low (\$100,000) compared to operation and maintenance costs of the existing airport ferry (\$1.1 million). Option C3 is considered a reasonable alternative because it is consistent with the purpose and need and it is below the cost limit established by the DOT&PF. This alternative is recommended for further study in the NEPA document.

4.2.7 Option C4: Modified High-level Bridge – Airport Area to Cambria Drive Area

This alternative would improve access between Revillagigedo and Gravina islands by providing access for vehicles to Borough and private lands on Gravina Island. Vehicle travel time from all locations on Revillagigedo Island to Ketchikan International Airport would improve by approximately 13 minutes. The road and bridge connection would be operational 24 hours per day and would provide more reliable access for travel between the two islands.

The primary environmental and transportation issues associated with this alternative include impacts to natural resources under the bridge structure and the effects of the bridge on shipping and floatplane operations in Tongass Narrows. The 1.4-km (0.9-mile) bridge span would shadow intertidal habitat and eelgrass beds, and bridge piers could affect juvenile fish movement in near-shore areas where the bridge parallels the shoreline of Gravina Island. The transportation issues associated with Option C4 include: the effects of construction equipment and activity in Tongass Narrows on marine navigation (including the existing airport ferry service) and floatplane and helicopter operations; the effects of the 76-meter (250-foot) bridge structure on floatplane maneuvers in Tongass Narrows and on aircraft operations at Ketchikan International Airport (the bridge would penetrate the horizontal and transitional surfaces requiring mitigation



through appropriate marking and lighting); and the effects of aligning the bridge over the floatplane dock at the airport. Marine navigation would be limited through the 168-meter (550-foot) horizontal span of the bridge and the U.S. Coast Guard may restrict vessel traffic to one way for large ships passing under the bridge.

The 50-year life cycle costs of \$147 million associated with Option C4 would be within the practical limit of project funding. Annual operation and maintenance costs of Option C4 would be low (\$100,000) compared to the annual operation and maintenance costs of the existing airport ferry (\$1.1 million). The cost of constructing, operating, and maintaining Option C4 would be reasonable. Option C4 is considered a reasonable alternative because it is consistent with the purpose and need statement and it is below the cost limit established by the DOT&PF. This alternative is recommended for further study in the NEPA document.

4.2.8 Option D1: Low-level Bridge – Airport Area

This alternative would improve access between Revillagigedo and Gravina islands by providing access for vehicles to Borough and private lands on Gravina Island. Vehicle travel time from all locations on Revillagigedo Island to Ketchikan International Airport would improve by approximately 16 minutes. The road and bridge connection would be operational 24 hours per day and would provide more reliable access for travel between the two islands.

The primary environmental and transportation issues associated with this alternative include impacts to natural resources under the bridge structure and the effects of the bridge on shipping and floatplane operations in Tongass Narrows. The 0.8-km (0.5-mile) bridge span would shadow intertidal habitat and eelgrass beds, and bridge piers could affect juvenile fish movement in near-shore areas. The primary transportation issue associated with Option D1 is related to its 37-meter (120-foot) vertical clearance, which would impede the passage of taller ships through Tongass Narrows. Ships calling in Ketchikan that require a vertical clearance greater than 37 meters (120 feet) would have to enter and leave the port from the south. In addition, impacts to floatplane operations would result from the alignment of the bridge in the vicinity of the floatplane dock at the airport.

The 50-year life cycle costs of \$86 million associated with Option D1 would be well within the practical limit of project funding. Annual operation and maintenance costs of Option D1 would be low (\$80,000) compared to the annual operation and maintenance costs of the existing airport ferry (\$1.1 million). Option D1 is consistent with the purpose and need of the project and the estimated project costs would be within the funding limit established by the DOT&PF. Option D1 is considered a reasonable alternative and is recommended for further study in the NEPA document.

4.2.9 Option D2: Low-level Moveable Bridge – Airport Area

This alternative would improve access between Revillagigedo and Gravina islands by providing access for vehicles to Borough and private lands on Gravina Island. Vehicle travel time from all locations on Revillagigedo Island to Ketchikan International Airport would improve by approximately 16 minutes. Although the road and bridge connection would be operational 24 hours per day, the moveable bridge would not improve the reliability of the access because bridge closures for ship passage would result in up to 35 minutes of unscheduled downtime for



each large vessel passage in Tongass Narrows. During the summer months, bridge closures could occur four to six times per day. Bridge closures could increase travel times to the extent that it would take longer to travel between the two islands than it does under existing conditions.

The primary environmental and transportation issues associated with this alternative include impacts to natural resources under the bridge structure and the effects of the bridge on shipping and floatplane operations in Tongass Narrows. The bridge's lift span would require over-water maintenance activities, including painting, cleaning, and maintenance of mechanical and electrical equipment, which could adversely affect water quality. The 0.8-km (0.5-mile) bridge span would shadow intertidal habitat and eelgrass beds, and bridge piers could affect juvenile fish movement in near-shore areas. The transportation issues associated with Option D2 include: the effects of construction equipment and activity in Tongass Narrows on marine navigation and floatplane and helicopter operations; the effects of the 91-meter (300-foot) bridge structure on floatplane maneuvers and on aircraft operations at Ketchikan International Airport (the bridge would penetrate the horizontal surface requiring mitigation through appropriate marking and lighting); and the effects of aligning the bridge in the vicinity of the floatplane dock at the airport.

The 50-year life cycle costs associated with Option D2 would be \$241 million, which exceeds the practical limit of project funding by \$66 million. While the annual operation and maintenance costs would be low (\$350,000) compared to the annual operation and maintenance costs of the existing airport ferry (\$1.1 million), the overall project costs of Option D2 would not be reasonable. Option D2 would not satisfy the purpose and need for the project because unscheduled bridge openings greatly reduce the reliability and convenience of the access and could increase travel times to greater than current levels. For these reasons Option D2 is not considered reasonable and is not recommended for additional analysis in the NEPA document.

4.2.10 Option E: Tunnel – Jefferson Street

This alternative would improve access between Revillagigedo and Gravina islands by providing access for vehicles to Borough and private lands on Gravina Island. However, use of the tunnel by vehicles carrying hazardous materials and vehicles that are oversized would be limited or prohibited. Vehicle travel time from all locations on Revillagigedo Island to Ketchikan International Airport would improve by 10 to 17 minutes. The road and tunnel connection would be operational 24 hours per day and, with the exception of vehicles carrying hazardous materials and vehicles that are oversized, would provide more reliable access for travel between the two islands.

The primary environmental and transportation issues associated with this alternative include impacts to natural resources along the roadway/tunnel corridor, the effects of construction on shipping and floatplane operations in Tongass Narrows, and the effects on traffic on Tongass Avenue. Construction of the tunnel for Option E would have adverse effects on marine resources along the 2.1-km (1.3-mile) tunnel corridor. Approximately 43,000 m² (11 acres) of wetlands on Gravina Island would be affected by the airport access road. Construction of the tunnel could interfere with shipping traffic and floatplane maneuvers in Tongass Narrows. Construction activities could also cause traffic congestion on Tongass Avenue at the Jefferson Street intersection, where average daily traffic (1999) is 17,978 vehicles.



The 50-year life cycle cost of \$301 million associated with Option E exceeds the practical limit of project funding by \$126 million. The annual operation and maintenance costs also would be high (\$2.8 million) compared to the existing annual operation and maintenance costs of the airport ferry (\$1.1 million). Option E is not considered reasonable due to the estimated cost being substantially higher than the practical funding limit established by DOT&PF. It is not recommended for further analysis in the NEPA document.

4.2.11 Option E2: Tunnel – Airport Area

This alternative would improve access between Revillagigedo and Gravina islands by providing access for vehicles to Borough and private lands on Gravina Island. However, use of the tunnel by vehicles carrying hazardous materials and vehicles that are oversized would be limited or prohibited. Vehicle travel times from all locations on Revillagigedo Island to Ketchikan International Airport would improve by 15 to 17 minutes. The road and tunnel connection would be operational 24 hours per day and, with the exception of vehicles carrying hazardous materials and vehicles that are oversized would provide more reliable access for travel between the two islands.

The primary environmental and transportation issues associated with this alternative include impacts to natural resources along the roadway/tunnel corridor and the effects of construction on shipping and floatplane operations in Tongass Narrows. Approximately 31,000 m² (8 acres) of wetlands would be affected. Construction of the tunnel for Option E2 would have adverse effects on marine resources along the 1.4-km (0.9-mile) tunnel corridor, including approximately 27,000 m² (6.7 acres) of subtidal habitat and approximately 34,000 m² (8.4 acres) of essential fish habitat. Construction of the tunnel could interfere with shipping traffic and floatplane maneuvers in Tongass Narrows.

The 50-year life cycle cost of \$385 million associated with Option E2 exceeds the practical limit of project funding by \$210 million. The annual operation and maintenance costs also would be high (\$2.9 million) compared to the annual operation and maintenance costs of the existing airport ferry (\$1.1 million). Option E2 is not considered reasonable due to the estimated cost being substantially higher than the practical funding limit established by DOT&PF. It is not recommended for further analysis in the NEPA document.

4.2.12 Option F1: High-level East Bridge/Low-level West Bridge – Pennock Island

This alternative would improve access between Revillagigedo and Gravina islands by providing access for vehicles to Borough and private lands on Gravina Island. Based on vehicular travel times, access to the airport would improve by 14 to 18 minutes for most people in Ketchikan; however, the travel time to the airport from Ward Cove and points north (representing approximately 24 percent of the population) would increase by 2 minutes. The road and bridge connections would be operational 24 hours per day and would provide more reliable access for travel between the two islands.

The primary environmental and transportation issues associated with this alternative include impacts to natural resources along the roadway corridor, potential impacts to cultural resources and subsistence use on Pennock Island, the potential effects of the bridges on shipping and



floatplane operations in Tongass Narrows, and the effects of funneling vehicle traffic through downtown Ketchikan to/from the crossing. Option F1 would traverse approximately 191,000 m² (47 acres) of wetlands on Pennock and Gravina islands and would adversely affect the use of those areas as wildlife habitat. Two anadromous streams would be crossed and would be affected by instream construction and runoff during long-term use of the roadway. Option F1 could potentially cross burial grounds on Pennock Island that may be considered eligible for the National Register of Historic Places. The transportation issues associated with Option F1 include the effects of a 76-meter (250-foot) high bridge across the east channel of Tongass Narrows on floatplane and helicopter operations and the effects of the alternative on vehicular traffic in downtown Ketchikan.

The 50-year life cycle costs associated with Option F1 would be \$198 million, which exceeds the practical limit of project funding by \$23 million. While annual operation and maintenance costs would be low (\$120,000) compared to the annual operation and maintenance costs of the existing airport ferry (\$1.1 million), the overall project costs of Option F1 would not be reasonable. Option F1 is not considered reasonable due to the estimated cost being substantially higher than the practical funding limit established by DOT&PF. It is not recommended for further analysis in the NEPA document.

4.2.13 Option F1: High-level Cable Stayed Bridge over East Channel– Pennock Island

This alternative would improve access between Revillagigedo and Gravina islands by providing access for vehicles to Borough and private lands on Gravina Island. Based on vehicular travel times, access to the airport would improve by 14 to 18 minutes for most people in Ketchikan; however, the travel time to the airport from Ward Cove and points north (representing approximately 24 percent of the population) would increase by 2 minutes. The road and bridge connections would be operational 24 hours per day and would provide more reliable access for travel between the two islands.

The primary environmental and transportation issues associated with this alternative include impacts to natural resources along the roadway corridor, potential impacts to cultural resources and subsistence use on Pennock Island, the potential effects of the bridges on shipping and floatplane operations in Tongass Narrows, and the effects of funneling vehicle traffic through downtown Ketchikan to/from the crossing. Option F1 would traverse approximately 191,000 m² (47 acres) of wetlands on Pennock and Gravina islands and would adversely affect the use of those areas as wildlife habitat. Two anadromous streams would be crossed and would be affected by instream construction and runoff during long-term use of the roadway. This alternative could potentially cross burial grounds on Pennock Island that may be considered eligible for the National Register of Historic Places. The transportation issues associated with this alternative include the effects of a 212-meter (695-foot) cable stayed structure over the east channel of Tongass Narrows on floatplane and helicopter operations and the effects of the alternative on vehicular traffic in downtown Ketchikan.

The 50-year life cycle costs associated with the Option F1 Cable Stayed alternative would be \$204 million, which exceeds the practical limit of project funding by \$29 million. While the annual operation and maintenance costs would be low (\$210,000) compared to the annual operation and maintenance costs of the existing airport ferry (\$1.1 million), the overall project



costs of this alternative would not be reasonable. Option F1, the High Level Cable Stayed alternative is not considered reasonable due to the estimated cost being substantially higher than the practical funding limit established by DOT&PF. It is not recommended for further analysis in the NEPA document.

4.2.14 Option F2: Tunnel under East Channel – Pennock Island

This alternative would improve access between Revillagigedo and Gravina islands by providing access for vehicles to Borough and private lands on Gravina Island; however, use of the tunnel by vehicles carrying hazardous materials and vehicles that are oversized or overweight would be limited or prohibited. Based on vehicular travel times, access to the airport would improve by 13 to 19 minutes from points south of the Ketchikan CBD (representing approximately 43 percent of the population); however, the travel time to the airport from Carlanna Creek and points north (representing approximately 57 percent of the population) would increase by 3 minutes. The road, tunnel, and bridge connection would be operational 24 hours per day and, with the exception of vehicles carrying hazardous materials and vehicles that are oversized or overweight, would provide more reliable access for travel between the two islands.

The primary environmental and transportation issues associated with this alternative include impacts to natural resources along the roadway/bridge/tunnel corridor, potential impacts to cultural resources and subsistence use on Pennock Island, and the effects of funneling traffic through downtown Ketchikan to reach the crossing. Option F2 would traverse approximately 192,000 m² (47 acres) of wetlands on Pennock and Gravina islands and would adversely affect the use of those areas as wildlife habitat. Two anadromous streams would be crossed and would be affected by instream construction and runoff during long-term use of the roadway. Option F2 could potentially cross burial grounds on Pennock Island that may be considered eligible for the National Register of Historic Places. The primary transportation issues associated with Option F2 are related to the effects of bridge traffic on increasing congestion in downtown Ketchikan.

The 50-year life cycle cost associated with Option F2 would be \$578 million, which exceeds the practical limit of project funding by \$403 million. The annual operation and maintenance costs also would be high (\$3.0 million) compared to the existing annual operation and maintenance costs of the airport ferry (\$1.1 million). Option F2 is not considered reasonable due to the estimated cost being substantially higher than the practical funding limit established by DOT&PF. It is not recommended for further analysis in the NEPA document.

4.2.15 Option F3: High-level Bridge over West Channel – Pennock Island

This alternative would improve access between Revillagigedo and Gravina islands by providing access for vehicles to Borough and private lands on Gravina Island. Based on vehicular travel times, access to the airport would improve by 14 to 18 minutes from destinations south of the Ketchikan CBD (representing approximately 43 percent of the population); however, the travel time to the airport from Carlanna Creek and points north (representing approximately 57 percent of the population) would increase by 2 minutes. The road and bridge connections would be operational 24 hours per day and would provide more reliable access for travel between the two islands.



The primary environmental and transportation issues associated with this alternative include impacts to natural resources along the roadway corridor, potential impacts to cultural resources and subsistence use on Pennock Island, the effects on ships requiring more than 18 meters (60 feet) of vertical clearance, and the effects of funneling vehicular traffic through downtown Ketchikan to reach the crossing. Option F3 would traverse approximately 191,000 m² (47 acres) of wetlands on Pennock and Gravina islands and would adversely affect the use of those areas as wildlife habitat. Two anadromous streams would be crossed and would be affected by instream construction and runoff during long-term use of the roadway. Option F3 could potentially cross burial grounds on Pennock Island that may be considered eligible for the National Register of Historic Places. The east channel bridge would restrict the passage of ships to those requiring 18 meters (60 feet) of vertical clearance or less. Taller ships would be directed to the west channel, where the vertical clearance would be 64 meters (210 feet) and the horizontal clearance would be 168 meters (550 feet) and the U.S. Coast Guard may restrict vessel traffic to one way for large ships passing under the bridge. Cruise ship pilots have expressed concern over navigating through the west channel due to shallow water at the north end of the channel. The primary transportation issues associated with Option F3 are related to the effects of bridge traffic on increasing congestion in downtown Ketchikan.

The 50-year life cycle costs associated with Option F3 would be \$175 million, which is at the practical limit of project funding. Annual operation and maintenance costs of Option C3 would be low (\$120,000) compared to operation and maintenance costs of the existing airport ferry (\$1.1 million). Option F3 is considered a reasonable alternative because it is consistent with the purpose and need and it is within the cost limit established by the DOT&PF. This alternative is recommended for further study in the NEPA document.

4.2.16 Option G1: Ferry – Refuge Cove

Option G1 is a new ferry alignment that crosses Tongass Narrows from Refuge Cove to Gravina Island. Under this alternative, the existing airport ferry would remain operational. Option G1 would result in improved access between Revillagigedo and Gravina islands by providing access for vehicles to Borough and private lands on Gravina Island and by providing an alternative to the existing airport ferry. Use of the G1 ferry would not improve convenience of access to Ketchikan International Airport with respect to vehicular travel time: vehicles traveling from Carlanna Creek and points south (representing approximately 76 percent of the population) would experience travel times that would be 27 minutes longer than the existing ferry, and vehicles traveling from Ward Cove and points north would experience travel times that would be 11 to 15 minutes longer than with the existing ferry. These travel times would increase during peak traffic periods as a result of congestion. Based on travel time comparisons, the existing ferry would remain as the most efficient transportation route for all vehicles traveling between Revillagigedo Island and Ketchikan International Airport. Travelers from areas north of Ward Cove (e.g., Point Higgins) destined for the airport in vehicles would experience shorter travel times by using the existing ferry rather than the new ferry, even though the new ferry would be closest to their point of origin. Reliability of access would improve slightly as a result of the additional ferry connection; however, travel between the islands would be limited by the ferry schedules.



The primary environmental and transportation issues associated with this alternative include potential impacts to Refuge Cove State Park (a Section 4(f) property), impacts associated with ferry vessel emissions and maintenance activities at the new terminals, impacts to natural resources from the airport access road, and the effects of the additional ferry traffic on marine navigation. Option G1 could affect navigation in and around the two small boat harbors located in Refuge Cove. Effects on a Section 4(f) property could not be avoided under Option G1 without taking residential properties that occupy the land to the north and south of Refuge Cove State Park. Houses are dispersed along the shoreline surrounding Refuge Cove and boat houses occur within Mud Bay, which is located immediately north of Refuge Cove. In addition to Section 4(f) impacts, Option G1 would adversely affect approximately 207,000 m² (51 acres) of wetlands as a result of construction of the access road from the Gravina Island ferry terminal to the airport terminal. Two anadromous streams would be crossed by the access road and would be affected by instream construction and runoff during long-term use of the roadway. The transportation issues associated with Option G1 are associated with the potential conflicts created between the additional cross-channel ferry route and ships travelling through Tongass Narrows.

The 50-year life cycle costs of \$146 million associated with Option G1 would be within the practical limit of project funding. Annual operation and maintenance costs of Option G1 would be higher (\$3.3 million) than the annual operation and maintenance costs of the existing airport ferry (\$1.1 million). The life cycle costs of Option G1 would be reasonable with respect to the state-determined funding threshold. Option G1 does not meet the purpose and need for the project because it would not improve the overall convenience and reliability of access to Ketchikan International Airport. As shown on the fact sheet map, this alternative also would affect a Section 4(f) property. Avoidance of Refuge Cove State Park would require the taking of existing residential and commercial properties to the north or south of the park. In addition to the impact to residential and commercial property, locating the ferry terminal north of the park would increase the travel time for a greater majority of travelers to the airport, which would further decrease the convenience of this alternative. Locating the ferry terminal south of the park would require routing the ferry around the Channel/Danger Islands complex and reefs, which would pose safety risks as well as environmental impacts, in addition to the loss of marinas and/or residential properties. Locating the terminal south of Channel/Danger Islands complex and reefs and south of the marinas and residential properties would require use of the Ketchikan Pulp Company landfill site, a site currently undergoing remediation. Further south is Ward Cove: placing the terminal in Ward Cove would increase the amount of ferry travel time because the travel distance over water would be longer. Moving the terminal to a location south of Ward Cove approximates the location of Option G2, thereby eliminating the necessity for Option G1. For these reasons, Option G1 is considered unreasonable and is not recommended for additional analysis in the NEPA document.

4.2.17 Option G2: Ferry – Peninsula Point

Option G2 is a new ferry alignment that crosses Tongass Narrows from Peninsula Point on Revillagigedo Island to Lewis Point on Gravina Island. Under this alternative, the existing airport ferry would remain operational. Option G2 would result in improved access between Revillagigedo and Gravina islands by providing access for vehicles to Borough and private lands on Gravina Island and by providing an alternative to the existing airport ferry. Use of the G2 ferry would not improve convenience of access to Ketchikan International Airport with respect



to vehicular travel time: vehicles traveling from Carlanna Creek and points south (representing approximately 76 percent of the population) would experience travel times that would be 13 minutes longer than the existing ferry, and vehicles traveling from Ward Cove and points north would experience travel times that would be 7 minutes longer than with the existing ferry. These travel times would increase during peak traffic periods as a result of congestion. Based on travel time comparisons, the existing ferry would remain as the most efficient transportation route for all vehicles traveling between Revillagigedo Island and Ketchikan International Airport. Travelers from Ward Cove and areas to the north destined specifically for the airport in vehicles would experience shorter travel times by using the existing ferry rather than the new ferry, even though the new ferry would be closest to their point of origin. Reliability of access would improve slightly as a result of the additional ferry connection; however, travel between the islands would be restricted by the ferry schedules. The ferries would be operational 16 hours per day.

The primary environmental and transportation issues associated with this alternative include impacts associated with ferry vessel emissions and maintenance activities at the new terminals, impacts to natural resources from the ferry terminal and airport access road, and the effects of the additional ferry traffic on marine navigation. Option G2 would have adverse effects on natural resources as a result of ferry emissions and maintenance activities at the terminals. Approximately 71,000 m² (18 acres) of wetlands would be adversely affected by construction of the access road from the Gravina Island ferry terminal to the airport terminal. An active bald eagle nest on Lewis Point and bear and deer foraging habitat in a unique sedge meadow on the north side of Lewis Point would be adversely affected by activities at the ferry terminal there. The transportation issues associated with Option G2 are associated with the potential conflicts created between the additional cross-channel ferry route and ships travelling through Tongass Narrows. Option G2 may affect operations at the floatplane base on Peninsula Point.

The 50-year life cycle costs of \$141 million associated with Option G2 would be within the practical limit of project funding. Annual operation and maintenance costs of Option G2 would be higher (\$3.3 million) than the annual operation and maintenance costs of the existing airport ferry (\$1.1 million). The life cycle costs of Option G2 would be reasonable with respect to the state-determined funding threshold. Although this alternative falls short in its ability to address the project need to improve the overall convenience and reliability of access to Ketchikan International Airport and would have adverse effects on sensitive wildlife habitat on Lewis Point, the impacts identified to date are not considered unreasonable. Option G2 is recommended for additional analysis in the NEPA document.

4.2.18 Option G3: Ferry – Downtown

Option G3 is a new ferry alignment that crosses Tongass Narrows from downtown Ketchikan to a location on Gravina Island south of the airport. Under this alternative, the existing airport ferry would remain operational. Option G3 would result in improved access between Revillagigedo and Gravina islands by providing access for vehicles to Borough and private lands on Gravina Island and by providing an alternative to the existing airport ferry. Use of the G3 ferry would not improve convenience of access to Ketchikan International Airport with respect to vehicular travel time: vehicles traveling from Carlanna Creek and points north (representing approximately 57 percent of the population) would experience travel times that would be 14 minutes longer



than the existing ferry, and vehicles traveling from downtown Ketchikan and Saxman would experience the same travel times as with the existing ferry. These travel times would increase during peak traffic periods as a result of congestion. Based on travel time comparisons, the existing ferry would remain as the most efficient transportation route between Revillagigedo Island and Ketchikan International Airport for vehicular travel from Carlanna Creek and points north. Reliability of access would improve slightly as a result of the additional ferry connection; however travel between the islands would be restricted by the ferry schedules.

The primary environmental and transportation issues associated with this alternative include impacts associated with ferry vessel emissions and maintenance activities at the new terminals, impacts to natural resources from the airport access road, the effects of the additional ferry traffic on marine navigation, and impacts to existing land use and traffic at the new ferry terminal in downtown Ketchikan. Option G3 would have adverse effects on natural resources as a result of ferry emissions and maintenance activities at the terminals. Approximately 50,000 m² (12 acres) of wetlands would be adversely affected by construction of the access road from the Gravina Island ferry terminal to the airport terminal. Existing commercial development at the proposed location of the new ferry terminal in downtown Ketchikan would have to be relocated. With respect to transportation, Option G3 would create potential conflicts between the additional cross-channel ferry route and ships travelling through Tongass Narrows. In addition, the introduction of vehicular traffic from the ferry in downtown Ketchikan could be detrimental to traffic flow on Tongass Avenue at the Jefferson Street intersection where the average daily traffic (1999) is 17,978 vehicles.

The 50-year life cycle costs of \$122 million associated with Option G3 would be within the practical limit of project funding. Annual operation and maintenance costs of Option G3 would be higher (\$3.3 million) than the annual operation and maintenance costs of the existing airport ferry (\$1.1 million). The life cycle costs of Option G3 would be reasonable. Although this alternative falls short in its ability to address the project need to improve the overall convenience and reliability of access to Ketchikan International Airport, it would improve the convenience of travel to the airport for the populations in downtown Ketchikan and Saxman. Considering the combination of cost, environmental, transportation, and purpose and need factors, Option G3 is proposed as a reasonable alternative for the Gravina Access Project.

4.2.19 Option G4: Ferry – Expanded Existing

Option G4 is a new ferry alignment that crosses Tongass Narrows at approximately the same location as the existing airport ferry. Under this alternative, the existing airport ferry would remain operational. Option G4 would result in improved access between Revillagigedo and Gravina islands by providing access for vehicles to Borough and private lands on Gravina Island and by providing an alternative to the existing airport ferry. Vehicular travel times would be shortened by approximately 3 minutes as a result of the additional ferry service between the airport and Carlanna Creek ferry terminals. The additional ferry would improve the reliability of access to Gravina Island and Ketchikan International Airport, and improve the efficiency and convenience of access by shortening vehicular travel times to/from the airport by 3 minutes. Reliability of access would improve as a result of the additional ferry connection; however travel between the islands would be restricted by the ferry schedules.



The primary environmental issues associated with this alternative is the potential adverse effects on natural resources as a result of ferry emissions and maintenance activities at the terminals. The primary transportation issues associated with Option G4 are associated with the potential conflicts created between the additional cross-channel ferry route and ships travelling through Tongass Narrows.

The 50-year life cycle costs of \$118 million associated with Option G4 would be within the practical limit of project funding. Annual operation and maintenance costs of Option G4 would be higher (\$3.3 million) than the annual operation and maintenance costs of the existing airport ferry (\$1.1 million). The life cycle costs of Option G4 would be reasonable. Option G4 is consistent with the purpose and need of the project and the project costs would be within the funding limit established by the DOT&PF. Option G4 is a reasonable alternative for the Gravina Access Project.

4.3 Conclusion

Our analysis identified Options C3, C4, D1, F3, G2, G3, and G4 as reasonable alternatives for the Gravina Access Project. The recommended reasonable alternatives to be studied in detail in the NEPA document along with the no action alternative are Options C3, C4, D1, F3, G2, G3, and G4. These reasonable alternatives and the no action alternative are being forwarded to the state and federal agencies⁶ for formal concurrence under the interagency NEPA and Section 404 merger agreement.

⁶ The agencies participating in the formal concurrence process include the Alaska Department of Fish and Game, the Alaska Department of Environmental Conservation; the Alaska Department of Natural Resources; the U.S. Environmental Protection Agency; the U.S. Army Corps of Engineers; the National Marine Fisheries Service; and the U.S. Fish and Wildlife Service.



APPENDIX A

Life Cycle Costs



APPENDIX B

Explanation of Methods Used to Determine Potential Impacts to Natural Resources from Gravina Access Project



APPENDIX C
Letter from the Federal Aviation Administration
John J. Schommer, Obstruction Evaluation Specialist
Dated September 21, 2000



APPENDIX D

Travel Time Calculations

